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An Evaluation of Strategies to Control Noise from Air Conditioning and Refrigeration Condensing Units

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AN EVALUATION OF STRATEGIES TO CONTROL NOISE FROM AIR CONDITIONING AND REFRIGERATION CONDENSING UNITS

DECEMBER 1981

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Noise Abatement and Control
Washington, D. C. 20460

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This report details the strategies evaluated and assesses the experiences encountered in the investigation of noise from air conditioning and refrigeration condensing units in the State of Maryland. Each is designed to provide guidance for other state and local noise programs faced with similar noise problems. Hence, emphasis is placed on the practical aspects of attempting to implement innovative approaches. These included: (1) Sample selection, (2) noise measurement survey, (3) implementation of aggressive abatement procedures, (4) development and use of a screening graph for determining acceptability of sound rated outdoor unitary equipment, (5) incorporation of noise control considerations into The Division of Food Control, (6) exploration of an operational curfew, (7) development of an incentive/information program.

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Foreword

In October, 1976, the U.S. Environmental Protection Agency (EPA) contracted with the Metropolitan Washington Council of Governments (COG) to develop a plan to evaluate specific noise control strategies in a major metropolitan area. During the performance of that contract, staff from COG and six of its area jurisdictions, identified noise source targets for study and developed a series of potential strategies for evaluation. The overall plan was then presented to EPA for their consideration for funding of the implementation phase.

The contract for the implementation phase of the study was awarded in September, 1977. Specific work elements included the development of two educational modules and the investigation of control strategies for grain dryers, air conditioning and refrigeration units, minibikes and refuse collection vehicles. For each specific noise source to be studied, a jurisdiction within the metropolitan Washington area was selected to work with COG in the investigation.

This report on the noise from air conditioning and refrigeration units is one of a series describing each of the activities undertaken. The format for each report details the strategies evaluated and assesses the experiences encountered. Each is designed to provide guidance for other state and local noise programs faced with similar noise problems. Hence, emphasis is placed on the practical aspects of attempting to implement innovative approaches.

The investigation of noise from air conditioning and refrigeration condensing units in the State of Maryland was completed by the Environmental Health Administration's Division of Noise Control staff under subcontract to the Metropolitan Washington Council of Governments. A summary of the State of Maryland's noise control program is presented in Appendix 1. The elements of the air conditioning and refrigeration condensing units report include: (1) sample selection, (2) noise measurement survey, (3) implementation of aggressive abatement procedures, (4) development and use of a screening graph for determining acceptibility of sound rated outdoor unitary equipment, (5) incorporation of noise control considerations into The Division of Food Control, (6) exploration of an operational curfew, and (7) development of an incentive/information program.

Introduction

Air conditioning and/or refrigeration condensing units are typically located wherever shopping centers, supermarkets and office buildings are found. Air conditioning and refrigeration condensing units are used primarily to provide comforatble space conditions for the occupants of a building or to refrigerate food products for safe storage. For either purpose, the operation of the condensing unit is essentially identical.

The noise problem is invariably caused by the air-cooled condensing unit which consists of refrigerant condensing coils, a fan or fans to force air through the coils, a compressor and control circuitry. These items are normally assembled together in a single package which is suitable for installation on a roof or on a pad on the ground.

The noise emitted by a condensing unit is largely caused by the fan and the movement of air through the coils although the compressor can be a contributing factor. The condensing unit is usually located at the rear of a commercial establishment for reasons of service, aesthetics and noise. Typical noise levels measured at 20 feet from the unit are sometimes as high as 70 dBA. It is customary to locate stores to the rear of shopping centers with parking to the front and sides. This practice can create problems in areas where the shopping center or other commercial property is situated adjacent to residential property.

Report of Investigations and Findings

In this section, each of the noise control alternatives, for commercial air conditioner system noise which were investigated, is described. In the discussion of each phase of the study information which may be of assistance to other state and local noise control officials, faced with similar problems is presented.

Sample Selection and Noise Measurement Data

Inasmuch as the resources available for the completion of this study were somewhat limited, the authors were anxious to identify a sample situation from which maximum benefit could be derived. It was observed that shopping centers are frequently located in areas where noise from the condensing units impact residential properties. Further review of the noise complaint records showed a number of complaints resulting from these situations. Thus, it was determined this study would focus on commercial air conditioning and refrigeration condensing units located in shopping center areas. No attempt was made to delineate a specific size unit for study, however, major concern was given to location and impact on residential property.

During the sample identification period, Maryland's noise control program had become the Division of Noise Control within the Bureau of Food and Drug Control. This bureau is responsible for both review of plans for all future food service installations and periodic inspections of existing facilities. It, therefore, became obvious that concentration of this study on condensing units, associated with food service installations, would be ideal because of the potential for the ultimate incorporation of noise as an element in the plan review and inspection process.

In order to obtain baseline information about the extent of the impact of commercial air conditioner system noise on residential property, noise measurements were taken at 40 sites. The measurement sites were selected in a random manner, except that it was considered preferable to select a site where noise was caused primarily by a single condensing unit. At each site, a sketch Appendix 2 was prepared to show the location of buildings, the condensing unit and other items of interest. Pictures of some of the typical situations are shown in Appendix 3. The local zoning office was contacted to get the zoning status of the involved properties.

The procedure at each measurement site was to walk along the property line and mark the observed sound pressure levels on the location sketch. The wind speed was measured occasionally to assure that it was not higher than 15 mph and would not interfere with the measurements. Sound level meters that were used for this

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survey included the Bruel & Kjaer 2209, GenRad 1933 and the GenRad 1981B. All of these meters are Type I precision instruments. The sound level meter was calibrated prior to and following each set of measurements.

Site locations and the results of the survey are shown in Appendix 2. Examination of the location sketches and associated sound pressure levels provides a baseline impression of the typical impact of the air conditioning systems on adjacent residential properties.

Figure 1 is a cumulative percentage distribution of the maximum sound pressure level observed at the property line for all the measurement sites. This figure shows that only 12% of the survey locations are in violation of the 65 dBA currently allowable during daytime hours in a residential area in the State of Maryland. However, 68% of the survey locations would be in violation of the 55 dBA currently allowable during nighttime hours in a residential area if they were, in fact, in operation.

From this measurement sample, it appears that commercial air conditioning systems are not likely to be in violation of existing Maryland daytime noise regulations but that a serious nighttime problem is occurring. However, many localities have more stringent daytime regulations. In these cases, violations are quite likely. For Maryland, the implication of these findings is that an aggressive program in the night hours is necessary, particularly, in situations where residential areas are impacted.

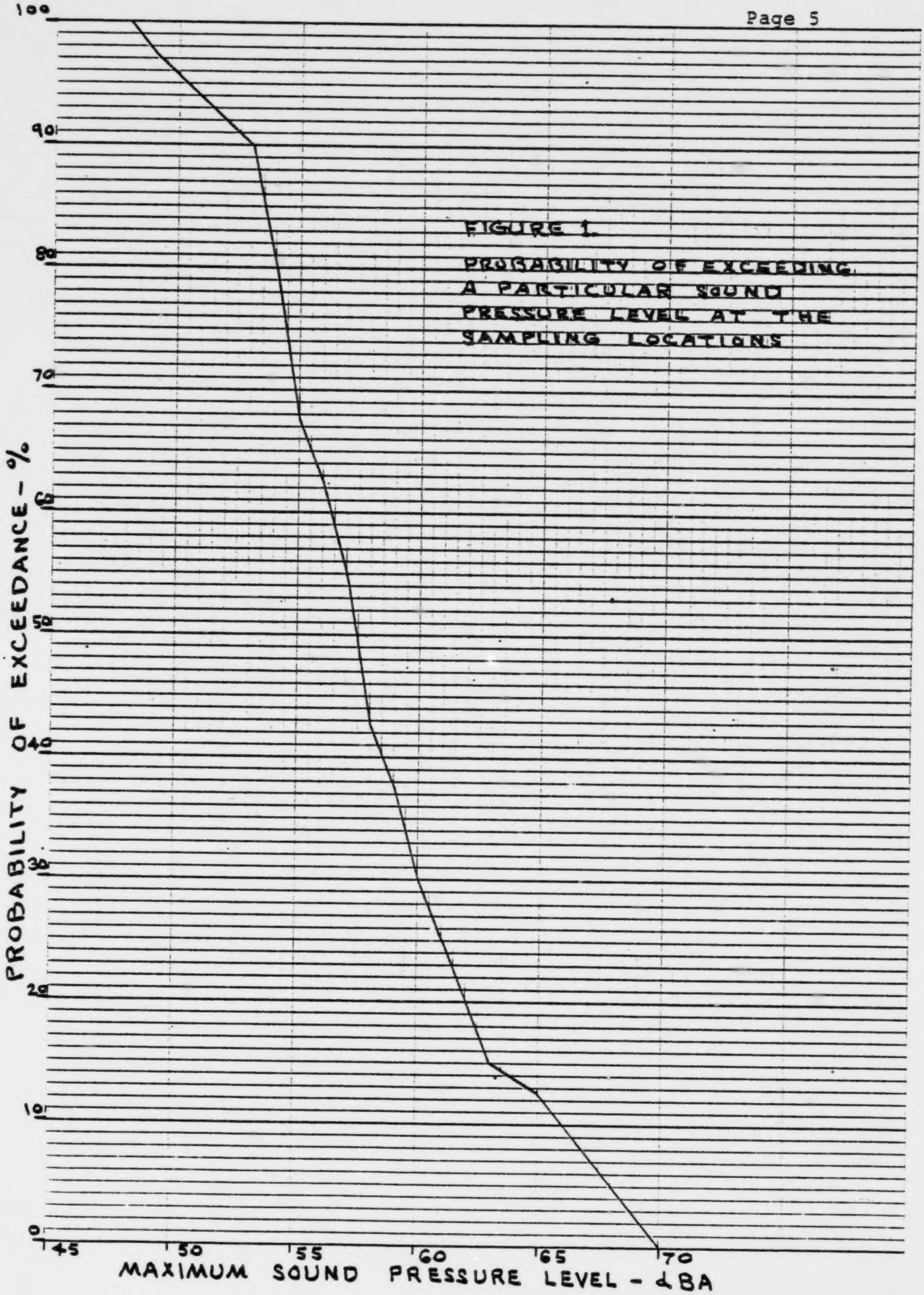

FIGURE 1.

PROBABILITY OF EXCEEDING A PARTICULAR SOUND PRESSURE LEVEL AT THE SAMPLING LOCATIONS

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Abatement Procedures:
Citing of Violators/Control Techniques

This study represented the initiation of an aggressive approach to the control of noise from condensing units in the State of Maryland. Maryland noise regulations, in a residential area, presently allow 65 dBA during daytime hours and 55 dBA during nighttime hours. At the sampling locations, measured noise levels in excess of these limits were evaluated to determine that the particular condensing unit under study was indeed the primary, if not sole, contributor to the measured levels. Personnel at the facility were verbally informed at those locations where a violation was observed or would occur if the condensing unit were operated at night. Written notification, the first formal step in the abatement process, followed. This notification includes a certified letter and standard form, "Report of Observation of Violation," (Appendix 4) which notifies the owner of the facility of the nature and extent of the violation, and proposes a general abatement timetable for corrective action or establishes a date on or before which such a timetable is to be submitted.

Careful attention is required during the previously described process because of the language of the Environmental Noise Act of 1974, which specifically requires that violators be given a "reasonable" period of time to comply prior to instituting legal action; and that violations be established as "willful." The time allowed for corrective action is determined by the judgment of the noise control personnel with or without obtaining third party (consultant) evaluation of the situation. Establishing a willful violation is accomplished by the certified letter which establishes a time period for either correction or the submittal of an abatement plan beyond which any continuing violation will be considered willful in nature and subject to the penalty provisions of the Act.

Alternatives exist for the procedure beyond the establishment of a willful violation. The principal ones are the administrative order, the formal plan for compliance and the variance. The administrative order may be issued by the Director, Environmental Health Administration or by the Secretary, Department of Health and Mental Hygiene as the case dictates. This order directs the violator to take specific action during a given time period, or to face prosecution and/or penalty.

The Plan for Compliance (PFC) is a legally binding agreement between the executive(s) of a facility in violation of noise regulations and the department in which specific abatement actions are prescribed over a period of time in order to spread the costs of compliance over several months. Default in the terms of the PFC may result in immediate legal action.

The PFC exists primarily to ease costs of modifications; whereas, the variance procedure exists for situations for which practical, state-of-the-art solutions do not currently exist. The applicant for a variance must advertise for a public hearing, declare his reasons why control is impractical, and agree to take action as technology becomes available. Variances are granted by the Secretary and are renewable if necessary upon presentation of documented evidence in support of such action. In order to provide suggestions for possible approaches to reducing noise from the condensing units, the authors collected information to assist those persons cited for violation. As previously discussed, the noise emitted by a condensing unit is largely caused by the fan and the movement of air through the coils. Sometimes the compressor is a contributing factor. Approaches to the problem include: (1) enclosures or modifications to the unit, (2) replacement with a quieter unit, (3) modifications of the transmission path through barriers or relocation, and (4) operational curfews. In some cases, a combination of these approaches is necessary.

Reduction of condensing unit noise by the source modification technique typically involves either an enclosure or replacement of the existing unit with a quieter one. The replacement approach, though highly effective, tends to be unsatisfactory in terms of the cost involved. It should, however, be considered since modification or relocation costs are sometimes quite expensive too. In these situations, the practicality of expenditures related to modifying an older unit versus replacement of the unit should be carefully considered.

The Environmental Protection Agency, Region X, noise program performed a study to determine methods of reducing the noise impact of residential heat pumps[1] From this study, it was found that plywood enclosures, lined with acoustically absorbent material, could result in attenuations of up to 15 dBA. The design of an enclosure of this type must be carefully planned ensuring that sufficient cooling air is available to the condensing unit. Also, consideration must be given to the fact that sound radiation from the enclosed condensing unit may be highly directional.

Another option available for condensing unit noise control is modifications to the transmission path. This can be achieved through either increasing the length of the path or blocking the transmission of acoustic energy along the source-receptor path. Relocation of the condensing unit can provide an approximate 6 dB noise reduction with each doubling of the source-receptor path distance. An observation made during this study is that units are frequently located on roof tops in shopping center areas. In several cases, this location was most unfortunate. Many shopping centers are constructed at a lower elevation than the adjacent residential areas. In these situations, relocation of the condensing units to ground level would provide a natural barrier between the unit and the impacted residences. A barrier constructed to block the transmission of the acoustic energy is limited in performance only by its overall dimensions. Practical sizes can be expected to yield a 5 to 10 dB reduction in noise levels.

The practicality of an operational curfew as a control technique is discussed in the next section of this paper. Later in the paper, a brochure which was developed to assist owners in evaluating control techniques is presented.

Exploration of the Implementation of Operational Use Curfews:

Administratively, an operating curfew for air conditioning equipment that emits noise levels which infringe on nearby residential property could be implemented quickly to bring needed relief to affected persons. It would be completely effective and would not require any capital expenditures on the part of the air conditioning equipment owner to come into compliance with the State noise regulations. Nighttime surveillance and noise measurements would not generally have to be conducted by noise control personnel unless a complaint had been received. In some situations, a curfew is probably the only practical solution for those locations that cannot comply with the noise regulations even after other control measures, such as a barrier, have been employed. In a recent case, the barrier and curfew approach were combined to solve the noise problem. However, there are many factors which must be considered in assessing the overall practicality of a curfew.

To obtain accurate and current information about the effect of a nighttime curfew on air conditioning system performance and economics, four electric utility suppliers, two equipment manufacturers and the Air Conditioning and Refrigeration Institute were contacted by mail. Sample letters are shown in Appendix 5. This approach was used because it would yield accurate and current information about condensing unit operating costs when nighttime shutdown occurs. The replies that were received from four companies are displayed in Appendix 6. Companies were first asked whether there would be savings of energy and money obtained through the application of nighttime reduced cooling effect or shutdown. A potential energy savings was of particular interest due to current concern about energy consumption. Obviously, savings of money, which could be the result of use of less energy, would be a strong incentive for an owner to shut his air conditioning equipment off at night as a means of complying with the noise regulations. Conversely, operating cost penalty, if it were less than the cost of other control strategies, could be acceptable if energy consumption did not increase. Respondents generally agreed that nighttime shutdown or reduced cooling effect saved energy. However, all indicated there were many factors involved in such a statement. With respect to whether or not money could be saved, no single answer could be given. The reason being that the economic effect would be dependent on whether the equipment adds to the demand peak in the utility electrical charges while operating to cool the building for the next day's use. Electric service rate schedules are shown in Appendix 7.

Another question explored was whether there were building types for which nighttime shutdown or reduced cooling effect were not practical. The answer was that building usage patterns were the only major consideration. This factor indicates that continuous operation is preferable for any building with more than one work shift or any building that has high ventilation requirements such as a bowling alley.

In response to how much savings could be expected through nighttime shutdown, or reduced cooling effect, the companies indicated that a detailed analysis of a building's load profile, usage pattern and local rate structure was necessary. One utility company indicated that manufacturers have computer models under development to answer this question. Other statements by the respondents were:

1. Nighttime shutdown or setback of air conditioning systems should not be done if the weather forecast for the following day is for an extremely hot day because unsatisfactory space conditions during the occupied period could result.
2. In some cases, the air conditioning system is sized close to or somewhat less than the calculated heat gain. In these cases, shutting down the system at night could be unsatisfactory because the system might not be able to handle the "cool-down" load prior to the time the building is to be occupied.
3. Reduced cooling effect can increase the amount of energy that some systems use. An example is a terminal reheat

system. In this case, when the thermostat is set "up" from normal and a cooling load reduction occurs due to the building being vacated for the day, additional reheat energy will be required to temper the air to normal space conditions. It should, however, be noted this type of system is not in common usage.

The Carrier Corporation provided a detailed reply to the request for information. Included were formulae that could be used to obtain an approximation of the savings involved through nighttime shutdown or reduced cooling effect. The letter is presented in Appendix 6. An example is provided below to demonstrate the savings that might be achieved:

Design load = 240,000 BTUH

Unit capacity = 260,000 BTUH

Outdoor design condition 98° F

Indoor design condition 72° F

Setback condition 85° F for 10 hours

Building area 10,000 SF (square feet)

Building load per degree Δ T $= \dfrac{240{,}000}{(98-72)}\ \dfrac{\text{BTUH}}{^\circ\text{F}}$

$= 9{,}230\ \dfrac{\text{BTUH}}{^\circ\text{F}}$

BTU Saved $= 9{,}230\ \dfrac{\text{BTUH}}{^\circ\text{F}} \times (72-85)\ \text{F} \times 10\ \text{Hrs.}$

$= 1.2 \times 10^{6}$

Recovery BTU $= 0.197 \times 10{,}000\ \text{SF} \times (72-85)\,^\circ\text{F} = 25{,}600$

At the setback conditions in this example, the system is supplying only half of its design load. Therefore, about half of the installed capacity would be available for the "cool-down" operation provided that it occurs sufficiently early in the morning before outdoor temperatures have climbed above the setback temperature. The recovery time would be approximated as:

$$\text{Recovery time} = \frac{25{,}600 \text{ BTU}}{130{,}000 \text{ BTUH}} \cong 1/4 \text{ Hr.}$$

The figures shown in this example completely favor nighttime setback for the purpose of energy conservation. It should be pointed out, however, that these calculations have a very limited capacity for accuracy. In particular, the building load varies throughout the day with a minimum occurring during the night. Also, the energy recovery formula does not account for the thermal mass of the building. These errors would tend to reduce the energy saved, increase the recovery energy and increase the recovery time perhaps dramatically.

In answer to the cost of a nighttime setback, the reply from Carrier Corporation was not too specific regarding the economic impact. Carrier Corporation stated that one indication as to whether nighttime setback warranted further study could be obtained by the use of the energy estimates they presented and consideration of the local utility rate structure. It was further stated that "an estimate with any reasonable accuracy requires a detailed analysis of the building load profile, usage pattern and local rate structure."

The Baltimore office of the Trane Corporation supplied literature on their TRACE (Trane Air Conditioning Economics)[2] computer program which is designed to assist in the conservation of energy in new and existing buildings. Discussions with local Trane personnel revealed that TRACE was capable of completely revealing the exact economic consequences of nighttime shutdown of air conditioning systems in any particular building. However, since a single TRACE run can cost in excess of $1,500.00, this area of investigation was not pursued. In any case, the results would only be specific to a particular building. An attempt to arrive at general conclusions from one or more TRACE runs would be unwise.

In summary, there is reason to expect some energy savings through nighttime setback. The degree of savings and the effect on operating costs of the air conditioning system can only be answered after a thorough analysis of a particular situation. Also, in certain situations, nighttime setback may possibly adversely affect comfort conditions during the occupied period.

The major objections to a curfew include the fact that it could increase electricity costs because of demand factors during the "cool-down" phase. Also, it could cause unsatisfactory space conditions during the occupied period. In a particular case, an energy and economics analysis program such as the Trane air air conditioning economics computer program should help an owner decide whether it is preferable to shut the system down at night or spend money for barrier construction or equipment relocation. If necessary, performance of the system could be tested to see if satisfactory space conditions could be achieved with nighttime shutdown. Ideally, this test should be conducted when temperatures are quite warm and the demand for cooling is great. In some cases, the installation of additional system cooling capacity should be considered. This added capacity would make nighttime shutdown possible, if required.

In conclusion, this study of the practicality of an operational curfew as a strategy for noise control has demonstrated several points for consideration:

(1) Condensing unit operation noise is most likely to be in violation of the nighttime Maryland regulations for residential zones. An operational curfew would eliminate this problem effectively;

(2) It is likely that a curfew would result in energy conservation, however, economic benefits will not always be realized. Each situation must be evaluated on an individual basis before this determination can be made;

(3) In certain situations, a curfew might prevent attainment of satisfactory space conditions during the occupied period. If the situation were severe, there would be the possibility of lost person hours due to the unsatisfactory working environment;

(4) The implementation of a generalized operational curfew seems unwise due to the unique circumstances associated with various settings;

(5) Generally, a curfew should be explored as one possible control approach along with other solutions such as constructing an enclosure, relocating the unit and installing a barrier. In situations where the curfew can be implemented, it has the potential of being a cost effective, energy conserving solution. Individuals should be encouraged to test the curfew approach.

Incorporation of Noise Control Considerations into the Activities of the Division of Food Control, Bureau of Food and Drug Control, State of Maryland: An Approach to Mechanical Permits and Inspections:

One of the elements of the work program for this study was to explore the possibility of a mechanical permits program in the State of Maryland. For the purposes of this investigation, it was determined that an approach to this type of control strategy, which could be handled administratively through the Bureau of Food and Drug Control, was appropriate since the Division of Noise Control was within this bureau. From this initial reasoning, the idea of a combined permit/inspection program evolved.

The first task was to develop a screening tool suitable for rapid determination of the probable compliance of a given air conditioning/refrigeration condensing unit with existing and future State of Maryland noise regulations. Since the current number of sound level meters available in both the State and local programs in Maryland is quite limited, it was decided that a screening tool which did not necessitate a sound level meter would receive maximum use.

The Air conditioning and Refrigeration Institute (ARI) Standard 270-75[3/], Standard for Application of Sound Rated Outdoor Unitary Equipment, provides a nomogram for predicting the sound level resulting from the operation of outdoor sections of unitary air conditioning and heat pump equipment. The procedure is relatively simple but is not entirely suitable as a rapid screening tool for determing the acceptability of condensing units operating in a particular regulatory environment.

To use the ARI Standard procedure requires that a sound level number, SLN, be determined by adjustments to the sound rating number, SRN, of the equipment which is published in the Directory of Certified Sound Rated Outdoor Unitary Equipment, published by the ARI[4]. The SRN is adjusted by adding an equipment location factor, ELF, subtracting a barrier shielding factor, BSF, and subtracting a sound path factor, SPF. The ELF accounts for the fact that sound in a particular direction is amplified by the presence of reflecting surfaces and has a maximum value of 2. The BSF is used since noise is attenuated by barriers. The maximum BSF value is 6. SPF reflects the fact that sound is attenuated through building walls and has a value of zero outdoors and a maximum value of 7 indoors. The ARI procedure indicates that an error, E, of ± 4 dBA may exist between measured and predicted sound level values. Thus, the relationship between these variables may be expressed as:

$$E = \pm 4 \text{ dBA}$$

$$SLN = SRN + ELF - BSF - SPF$$

The purpose of the ARI screening graph is to provide a prediction tool that requires a minimum of effort and knowledge while retaining reasonable accuracy. Therefore, in adapting this graph for use with the Maryland noise regulations, certain assumptions were made. Since condensing units are frequently located between buildings, a value of 2 was used for ELF. BSF was assumed to be zero because barriers are rarely used. Since environmental noise regulation measurements are made outdoors, SPF is, therefore, also zero.

E was assumed to be + 4 dB to represent the worst possible case. Therefore, for the screening graph developed, the relationship between the variables is as follows:

$$E = +4 \text{ dBA}$$

$$SLN = SRN + 2 - 0 - 0$$

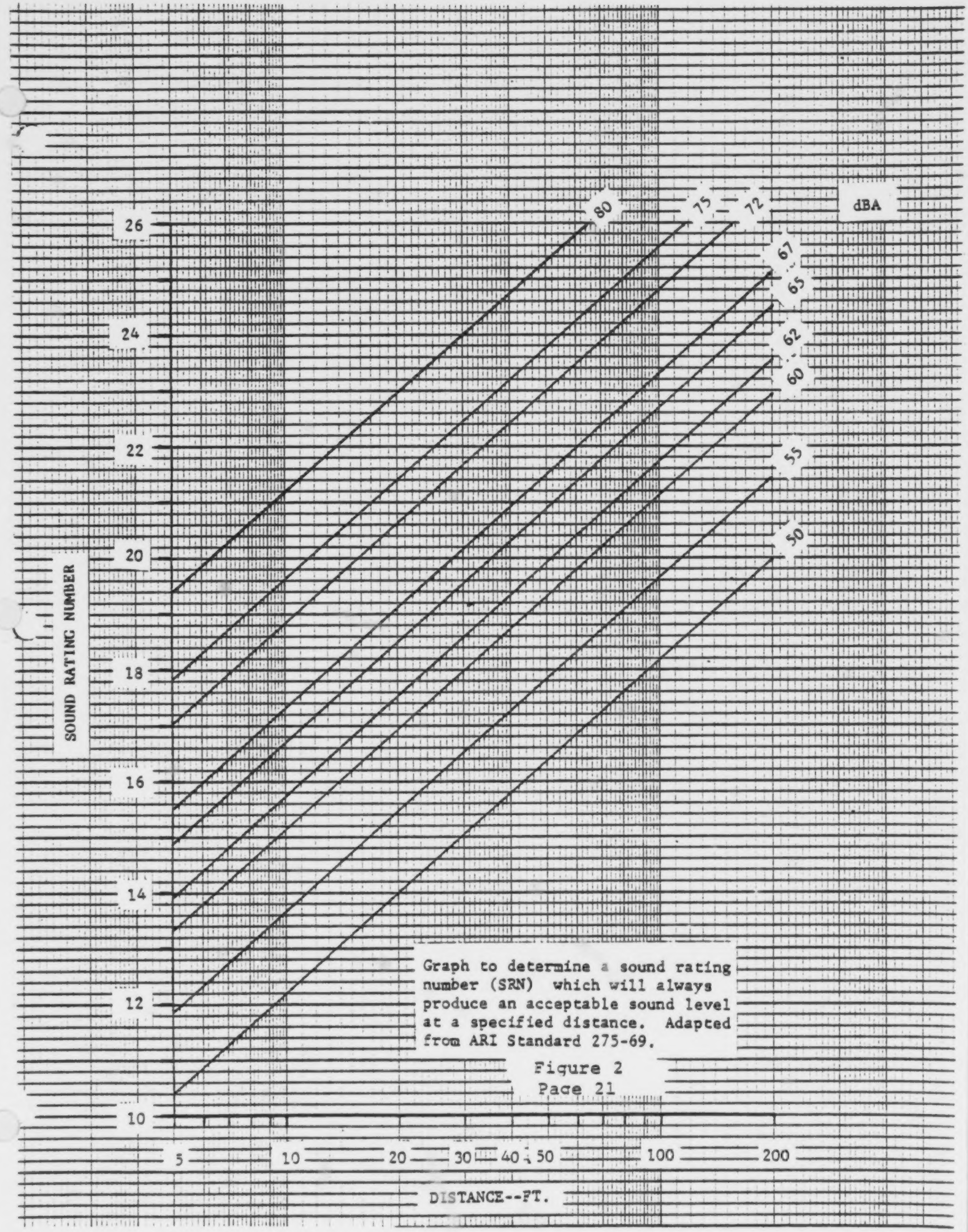
$$SLN = SRN + 2$$

The relationships discussed above were plotted on semi-logarithmic paper to give a straight line relationship between source-receptor distance and SRN. Curves were provided for all the present and future Maryland regulatory levels. The resulting graph is shown in Figure 2. The use of this graph is illustrated by the following examples which are shown in Figure 3.

(1) At a source-receptor distance of 100 feet, a condensing unit with a SRN of 19 or less will comply with a 55 dBA regulatory limit;

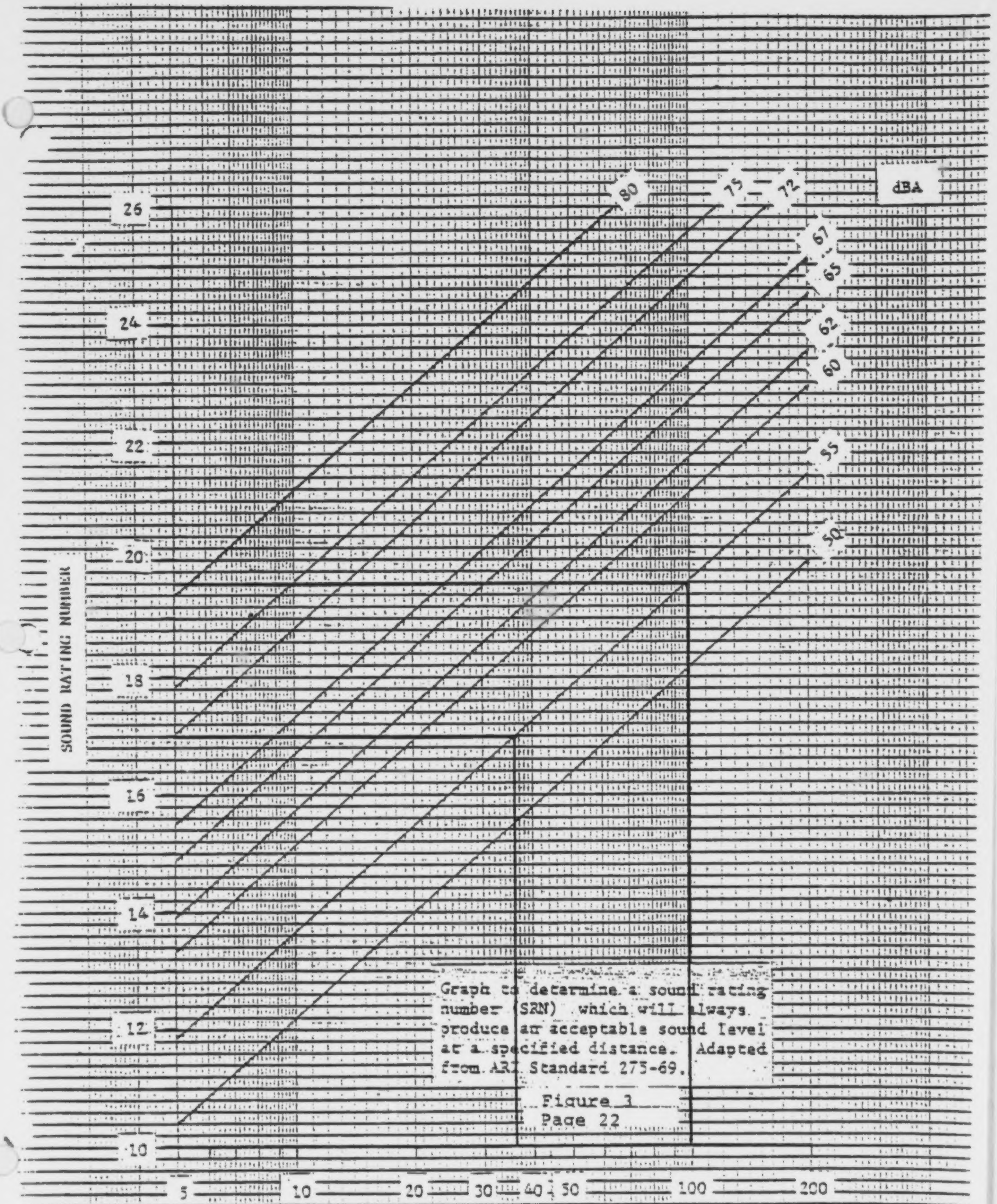
(2) A condensing unit with a SRN of 17 will comply with a 55 dBA regulatory limit if the source-receptor distance is 36 feet or more.

The examples demonstrate the flexibility of the nomograph. It can be entered at a fixed distance to find out what SRN is needed to comply with the Maryland noise regulations. Conversely, if the owner has a specific piece of equipment in mind, one can use the graph to determine the necessary distance to make it comply with the regulations.



Graph to determine a sound rating number (SRN) which will always produce an acceptable sound level at a specified distance. Adapted from ARI Standard 275-69.

Figure 2
Page 21



Graph to determine a sound rating number (SRN) which will always produce an acceptable sound level at a specified distance. Adapted from ARI Standard 275-69.

Figure 3
Page 22

Because of the assumptions employed in the screening graph, one may be sure that a unit that is indicated to be acceptable will, indeed, be acceptable. However, a unit that the screening graph indicates to be unacceptable might still be satisfactory. This is because of the worst case assumption used for screening purposes. If the unit is located 10 feet or more from a reflecting surface or a barrier is used, it will be necessary to use the complete ARI procedure to decide whether the unit is actually acceptable. For example, at a distance of 100 feet, a unit with a SRN of 26 could comply with a 55 dBA regulatory level if a barrier were used. The first example given above indicated that a SRN of 19 would be required. It is seen, therefore, that while the rapid screening graph gives results that will always assure compliance with any given regulatory noise level, its use will tend to give overly conservative results in some situations.

During a training session, the screening graph was pilot tested before the Anne Arundel County Department of Mechanical Inspections. Mr. Leo Shanks, Chief of that department, agreed to incorporate the screening graph into the county's review of construction applications. To add to the effectiveness of this project, a GenRad Type II sound level meter was loaned to the department for determining the compliance of newly installed equipment.

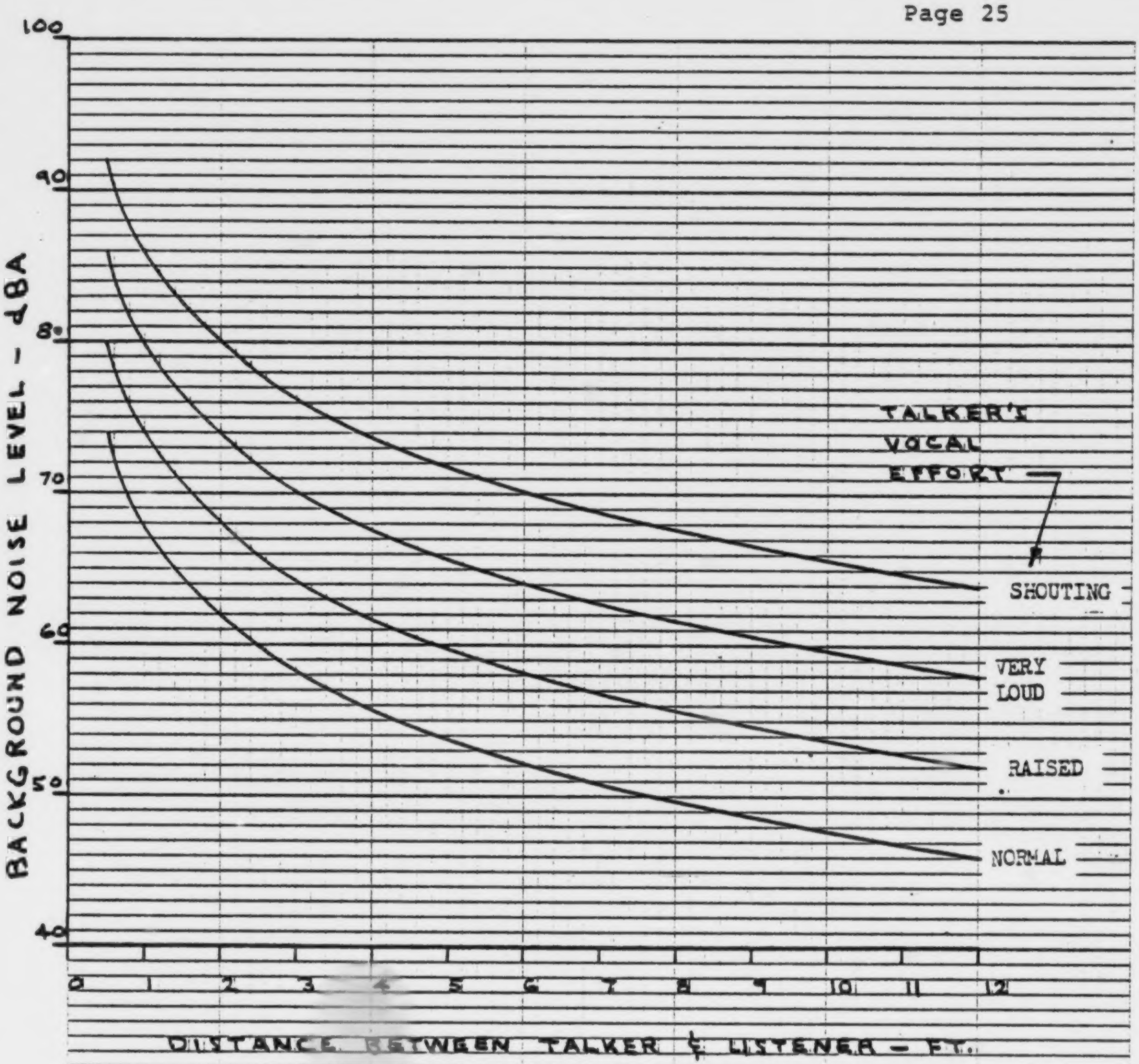
As an outgrowth of this training session, the Anne Arundel County Health Department has developed an interest in an overall noise program. State staff members have been providing assistance and equipment to foster this interest initially generated by this study.

To assist in fostering the incorporation of noise as a factor in inspections and existing food handling facilities, the concept of a Walk-Away Test was introduced. Through this approach, personnel inspecting food handling facilities might assist in the location of condensing units that are possibly in violation of Maryland noise regulations.

The Walk-Away Test was adapted from one presented in *Inspection of Federal Facilities for Compliance with Noise Abatement Standards*.[5] It is shown in Figure 4. Two persons engage in conversation, then they pace apart until speech becomes unintelligible. This distance is then related to noise level and the speaker's vocal effort to determine the approximate background noise level. In cases where the identified level possibly exceeds Maryland noise regulations, the inspector takes appropriate action.

Discussions were held with the Division of Food Control of the Community Health Programs to initiate plans for the inclusion of air and refrigeration condensing units into their plan review process and the inspection of condensing units at existing facilities.

Attempts to resolve how responsibility in this matter should be apportioned between the Division of Food Control, the Division of Noise Control and the local health departments were not entirely successful. While it was obvious that the Division of Noise Control must investigate situations where the Walk-Away Test indicates the possibility of a noise violation, no complete agreement was reached as to the preferred course of action when the screening graph



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Walk-away Noise Test: In a noisy area, engage a person in conversation. Pace apart until speech becomes unintelligible. Relate distance to noise level and talker's vocal effort to determine background noise level of noisy area. Adapted from Inspection Of Federal Facilities For Compliance With Noise Abatement Standards.

FIGURE 4

WALK-AWAY NOISE TEST

indicates that a violation may occur. In particular, there was concern about which division would refuse a construction application when it appears that a noise violation will occur. These concerns are inevitable whenever a new concept is introduced.

It was indicated by the Division of Food Control that the inclusion of air conditioning and refrigeration condensing units in the State centralized plan review of chains and franchises could be implemented immediately. However, the implementation of this procedure for the plan review of individual facilities at the local level would take longer due to problems associated with logistics and coordination with the 24 local jurisdictions.

Other factors which emerged from these discussions were as follows:

(1) The Food Services Facility inspection report cannot be changed without a regulation change since the report is an integral part of the regulations;

(2) More cooperation is likely to be obtained from the local health departments if the plan review for new condensing units is initiated at first;

(3) A more positive presentation can be made to the local health departments if a reasonably precise outline of responsibility can be stated;

(4) Factors such as distance to the property line from the condensing unit, zoning status of adjacent properties and condensing unit model number may be difficult to obtain as they are not clearly required to be submitted by regulation.

These mitigating factors have made it impossible t complish the introduction of noise as a factor in both view and inspection programs throughout the State durin course of this study. However, the pilot effort in Anne Arundel County has convinced the authors that it will be possible to accomplish this goal in time.

The approach presently planned is that the Division of Food Control will adopt the use of the screening graph in their centralized plan review program of chains and franchises. After the Division has had a reasonable period of time to work out any procedural problems with the screening graph, it is anticipated that the local health officers in the 24 jurisdictions will be requested to incorporate it into their local plan review activities. Following this, the Walk-Away Test will be introduced to evaluate existing facilities in the inspection program.

Other jurisdictions faced with noise problems from air conditioning and refrigeration condensing units are strongly encouraged to consider the approach described herein. Also, other jurisdictions should consider a similar approach to controlling other major noise sources for which existing plan review and inspection programs are available. It maximizes the effectiveness of small State level noise staffs through the use of local plan review and inspection personnel.

Development of an Incentive and Information Program:

A number of factors involved in this study have contributed either directly or indirectly to the development of an incentive and informational program in the State of Maryland. Prior to this study, the focus of the program had been responding to noise complaints received. This study represented the initiation of an aggressive approach to the identification and amelioration of specific noise source problems in the state. The letters, citations, and communications involved in this study provided an alerting mechanism regarding the state's concern about and commitment to control of noise from air conditioning and refrigeration condensing equipment. Discussion with noise staff members conducting the study provided owners of noisy equipment an opportunity to become aware of the problem and to learn about possible control approaches.

To maximize the dissemination of information obtained from this study and to generate greater concern for noise problems, a brochure, "Air Conditioning and Refrigeration Condensing Units: An Owners Guide to Noise Control" was prepared. The authors are indebted to Mr. Jon Crosby, Public Health Administration Associate, for his invaluable technical and design assistance in the preparation of the brochure. The brochure describes noise and its effects; provides examples of sound pressure levels produced by various activities; delineates the Maryland noise regulations and provides general tips on how to reduce noise. A copy of the brochure is shown in Appendix 8.

The brochure was developed primarily for distribution to owners of commercial air conditioning and refrigeration condensing equipment. However, it will also be used as a source of information for persons complaining about this type of noise. Other distribution plans include local Chambers of Commerce, local zoning and procurement offices, libraries, and associations of builders and food handlers.

The costs associated with the production of the brochure were relatively low. It provides a mechanism to reach a large audience when staff time precludes individual personal contacts. This is particularly valuable when one is trying to reduce noise from a source as prevalent as air conditioning and refrigeration condensing units. Although we were unable to obtain an approximation of the total number of units in the state, we were able to determine that there are 14,422 food handling facilities registered with the Bureau of Food and Drug Control. These facilities represent just one group of potential users of this type of equipment within the state.

The prevalence of air conditioning and refrigeration condensing unit noise problems is probably equally as great in other areas of the country. Other jurisdictions are encouraged to modify our brochure for their use by the insertion of applicable noise regulations in their area. If funds are not available for brochures, the information could be typed and reproduced for distribution.

Through the year, several opportunities for sharing the information from this study have evolved. The material has been presented to members so the Council of Governments Noise Technical Committee and attendants at EPA's Region III Noise Control Conference in Morgantown, West Virginia. In addition, attendants at the State of Maryland's Noise Control Conference held at the University of Maryland were given an opportunity to learn about the study, the availability of the brochure and the use of the nomograph. Among the 60 attendants at this Conference were procurement officers, planners, health officers; and noise control officials from the state of Maryland and surrounding jurisdictions. A final outgrowth was the implementation of a noise control program in Ann Arundel County, Maryland. This is described in greater detail earlier in the paper.

Discussion of Problems Encountered, Conclusions and Recommendations for Future Approaches to Commercial Air Conditioning/Refrigeration Condensor Unit Noise Control:

It is inevitable that problems will be encountered when a comprehensive study focused on a single noise source is conducted in concert with routine daily noise control responsibilities for an entire state. This is particularly true when the source of study has a somewhat seasonal nature. Normally air conditioning equipment is used extensively from June through August. At many commercial establishments, usage is frequent during the rest of the year also. Refrigeration condensing units, of course, operate throughout the year. Thus, a concentrated effort was required to complete the study.

Other problems which impeded progress were weather conditions such as wind or rain which were unsatisfactory for conducting noise measurements and intrusion of extraneous noise sources such as traffic which prevented inclusion of certain sites in the sample. In addition, the determination of the zoning status of the properties involved in the measurement sample generally required a trip to the appropriate local zoning office. There was also a time lag associated with obtaining responses to letters concerning the curfew alternative. These lags were anticipated because of the detailed information requested.

Property owners or managers were often curious and somewhat skeptical about the nature of the noise survey. However, most were cooperative in response to requests to turn units on so that sound level measurements could be made. It was discovered that it was often impossible to obtain specific identifying data regarding the make, model and serial number of the unit. Reasons included the non-accessibility of the unit, inability to locate the information on the unit, changes in property ownership since installation, etc. Although it would have been good to have this information, the study was not significantly affected since the primary concern was whether or not the noise levels exceeded Maryland regulations.

As a result of this study, the following observations and recommendations are made for controlling noise from air conditioning and refrigeration condensing units:

(1) Noise complaints can be anticipated when large commercial units are located in close proximity to residential properties;

(2) Noise control approaches include (a) enclosures or modifications to the unit; (b) replacement with a quieter unit; (c) modifications to the transmission path through barriers or relocation and (d) operational curfews. In some cases, a combination of these approaches is necessary to resolve the problem;

(3) Whenever possible, an operational curfew is an excellent control strategy. However, the feasibility of the curfew approach must be evaluated on an individual case basis. Information contained in this report will assist in making these evaluations;

(4) The incorporation of the consideration of noise from air conditioning and refrigeration condensing units into state and local plan review and inspection processes has great potential for reducing the number of noise problems;

(5) The use of a screening nomograph and the Walk Away Test described herein will assist other jurisdictions in the implementation of the use of plan review and inspection for controlling noise from air conditioning and refrigeration condensing units;

(6) The brochure, 'Air Conditioning and Refrigeration Condensing Units: An Owners Guide to Noise Control' is a relatively inexpensive way to gain widespread cooperation in controlling noise problems. Other jurisdictions should consider adapting the brochure for their use. Distribution plans should include

the Air Conditioning and Refrigeration Institute, local air conditioning and refrigeration unit installation companies, real estate brokers, local chambers of commerce, zoning inspection and procurement offices;

(7) Future studies should include demonstration oriented application of control measures to a unit or units in violation of noise regulations. The results of the study should receive wide dissemination in the popular press to maximize knowledge about the problem and possible solutions. It should be noted that this type of demonstration would require a prolonged time period for completion;

(8). The availability of the State of Maryland investigation of noise from air conditioning and refrigeration condensing units should be reported in Vibrations to alert other noise control officers to its availability.

References

1. U.S. Environmental Protection Agency, Region X Noise Program, Techniques for Controlling Noise from Residential Heat Pumps, Seattle, Washington.

2. The Trane Corporation, TRANE Air Contioning Economics (TRACE), La Crosse, Wisconsin, 1976.

3. Air Conditioning and Refrigeration Institute, Standard 270-75: ARI Standard for Sound Rating of Outdoor Unitary Equipment, Arlington, Virginia.

4. Air Conditioning and Refrigeration Institute, Directory of Certified Sound Rated Outdoor Unitary Equipment, Arlington, Virginia, 1978.

5. U.S. Environmental Protection Agency, Inspection of Federal Facilities for Compliance with Noise Abatement Standards, EPA 550/9-77-350, Washington, D.C., December, 1976.

Appendix 1

Brief History of Maryland's Environmental Noise Program:

Brief History of Maryland's Environmental Noise Program:

Maryland's Environmental Noise Program began in 1973 with the enactment of legislation which added "noise control" to the existing Air Quality Control Act (Article 43). This act established a Noise Pollution Control Advisory Council, empowered the Department of Health and Mental Hygiene to promulgate regulations, and required that regulations and subsequent amendments be approved by the General Assembly prior to becoming effective.

A 1972 Senate Resolution (number 102) initiated a transportation noise study by Bolt, Beranek, and Newman, Inc., consultants to the Maryland Department of Transportation, which provided background, supplemented by input by several State agencies resulting in the Environmental Noise Act of 1974.

The Environmental Noise Act of 1974 repealed and re-enacted with amendments the following Articles of Maryland Annotated Code: 35, Evidence; 41, Executive Department; 43, Health; 66 1/2, Motor Vehicles; 1A, Aviation; and Natural Resources. Responsibility for controlling noise emanating from sources normally within their purview was given the various agencies affected. Hence, the Maryland Motor Vehicle Administration and Maryland State Police promulgated and enforced, respectively, noise level limits for motor vehicles. Similarly the Department of Health and Mental Hygiene promulgated and enforced regulations controlling noise on private property (amended in 1978 to also include public property) and the Department of Natural Resources promulgated and enforced regulations for noise from off-road vehicles and boats. The Department of Health and Mental Hygiene served as the coordinator of State noise activities by providing the required endorsements to all limits and regulations of other agencies and by chairing the Interagency Noise Control Committee, also created by the Act.

Department of Health and Mental Hygiene regulations (see Appendix), adopted in 1975 after public hearings, were based on property-line levels for various zoning categories of property. Amendments in 1977 altered the measurement process by requiring that receiving land use be the criteria for judgement. Adequate provisions for variances, abatement schedules, and penalties were included in the original and retained in the amended version.

The enforcement of the regulations was conducted largely on a complaint response basis due to grossly inadequate resources. Some of the more significant types of noise problems and their solution are as follows:

1975: refrigeration systems - barriers
1976: sawmills - enclosures
1977: process steam vents - silencers
1978: concrete plants - berms

It should be noted that it has not been necessary to resort to litigation in the solution of the wide variety of noise problems encountered. This speaks well for both the compliance provisions of the regulations and the personnel of the program, who often had to exercise extraordinary patience and understanding.

Present personnel allocations while not great, indicate a trend toward moderate growth and program emphasis. The organization chart (Figure 5) shows staffing and the relation of the Division of Noise Control within the Community Health Programs.

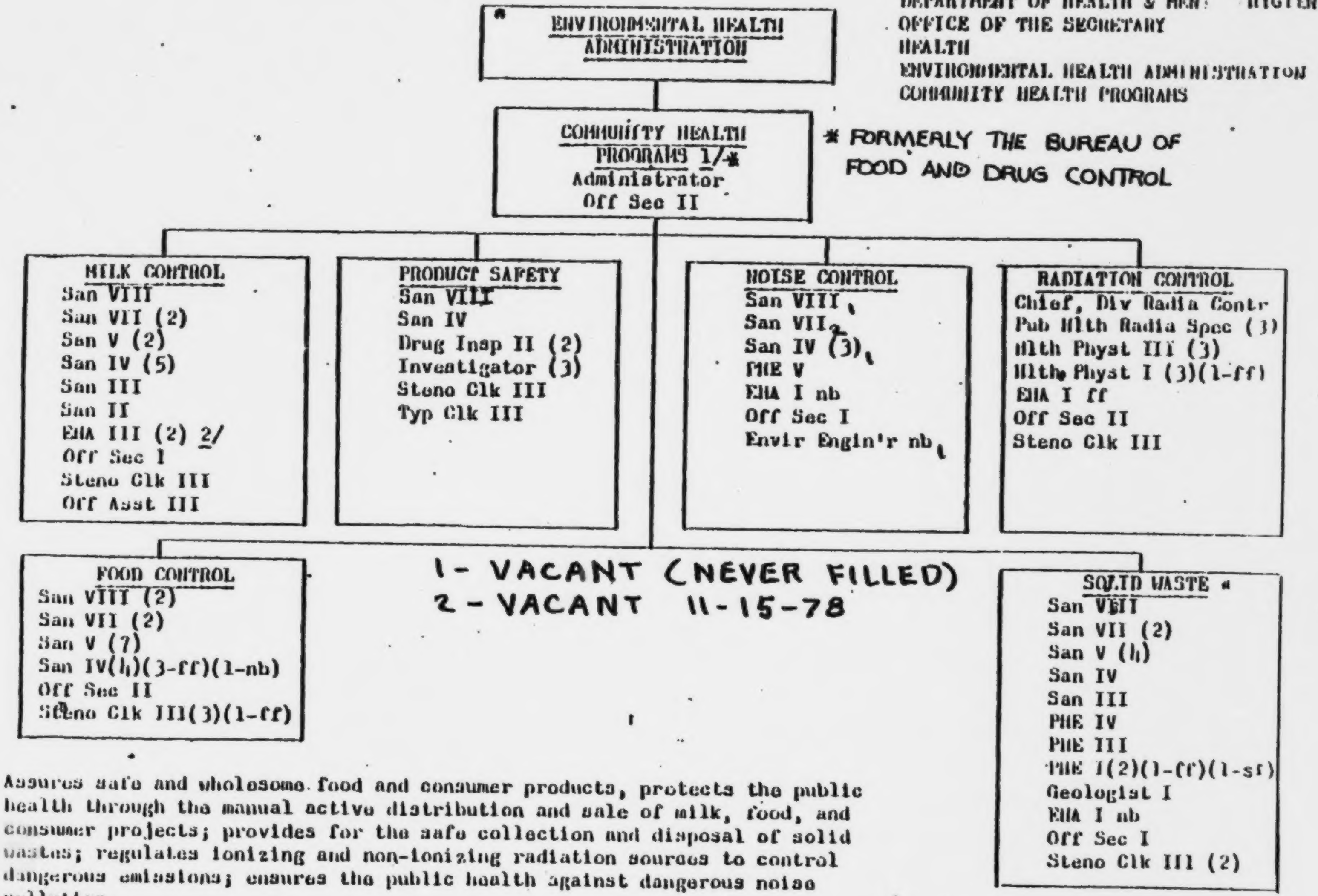
The Division's noise measurement equipment inventory has increased over the five years of operations from a single Type II sound level meter to the array listed in Table 1. In addition, the United States Environmental Protection Agency Region III Noise Program office has provided instrumentation and a mobile acoustics laboratory on a loan basis for extended periods. A truck was acquired from another program's discard pile and outfitted for noise measurements with auxiliary power, lights, and work/storage areas.

List of Equipment

Table 1

Manufacturer	Model	Item
Metrosonics, Inc.	dB-602	community noise analyzer and statistical descriptor microprocessor, L_n, P_1, L_{eq}, and L_{dn} capability in single and multiple interval modes.
GenRad Concord, MA	1985	dc recorder with Type I capability, compatible with GenRad Type I SLM.
"	1933	Precision SLM and Octave-band analyzer.
"	1565B	Type II SLM (2)
Bruel Kjaer Denmark	2209	Type 1 precision SLM and 1/3 Octave-band analyzer.

DEPARTMENT OF HEALTH & MENTAL HYGIENE
OFFICE OF THE SECRETARY
HEALTH
ENVIRONMENTAL HEALTH ADMINISTRATION
COMMUNITY HEALTH PROGRAMS


* ENVIRONMENTAL HEALTH ADMINISTRATION
COMMUNITY HEALTH PROGRAMS 1/*
Administrator
Off Sec II
MILK CONTROL
San VIII
San VII (2)
San V (2)
San IV (5)
San III
San II
EHA III (2) 2/
Off Sec I
Steno Clk III
Off Asst III
PRODUCT SAFETY
San VIII
San IV
Drug Insp II (2)
Investigator (3)
Steno Clk III
Typ Clk III
NOISE CONTROL
San VIII 1
San VII 2
San IV (3) 1
PHE V
EHA I nb
Off Sec I
Envir Engin'r nb 1
RADIATION CONTROL
Chief, Div Radia Contr
Pub Hlth Radia Spec (3)
Hlth Physt III (3)
Hlth Physt I (3)(1-ff)
EHA I ff
Off Sec II
Steno Clk III
FOOD CONTROL
San VIII (2)
San VII (2)
San V (7)
San IV(4)(3-ff)(1-nb)
Off Sec II
Steno Clk III(3)(1-ff)
SOLID WASTE *
San VIII
San VII (2)
San V (4)
San IV
San III
PHE IV
PHE III
PHE I(2)(1-ff)(1-sf)
Geologist I
EHA I nb
Off Sec I
Steno Clk III (2)

* FORMERLY THE BUREAU OF FOOD AND DRUG CONTROL

1 - VACANT (NEVER FILLED)
2 - VACANT 11-15-78

1/ Assures safe and wholesome food and consumer products, protects the public health through the manual active distribution and sale of milk, food, and consumer projects; provides for the safe collection and disposal of solid wastes; regulates ionizing and non-ionizing radiation sources to control dangerous emissions; ensures the public health against dangerous noise pollution.

2/ EHA - Environmental Health Aide

* Temporary Assignment

FIGURE 5
ORGANIZATION CHART

APPROVED Neil Solomon
NEIL SOLOMON, M.D., Ph.D., SECRETARY

DATE 6/6/78

TITLE 10 - DEPARTMENT OF HEALTH AND MENTAL HYGIENE
STATE ENVIRONMENTAL HEALTH ADMINISTRATION
10.03.45 RULES AND REGULATIONS GOVERNING THE CONTROL OF
NOISE POLLUTION IN MARYLAND

Pursuant to Article 43, Section 828 of the Annotated Code of Maryland, the following regulations governing the control of noise pollution in the State of Maryland are hereby established as requirements of the Department of Health and Mental Hygiene.

PREFACE

The Environmental Noise Act of 1974 of the State of Maryland declares as policy the limitation of noise to that level which will protect the health, general welfare and property of the people of the State. It requires that the Department assume responsibility for the jurisdiction over the level of noise, and prepare regulations for the control of noise, including the establishment of standards for ambient noise levels and equipment performance with respect to noise, for adoption by the Secretary of Health and Mental Hygiene. Enforcement of the regulations and standards is the responsibility of the Department in all areas, using the facilities and services of local agencies within the areas to the greatest extent possible. The Department shall coordinate the programs of all State agencies relating to noise abatement and each State agency prescribing sound level limits or regulations respecting noise shall obtain the endorsement of the Department in prescribing any such limits or regulations.

.01 Definitions.

A. ANSI means American National Standards Institute or its successor bodies.

B. Construction means any site preparation, assembly, erection, repair, alteration or similar activity.

C. Day - Night Average Sound Level (L_{dn}) means in decibels, the energy average sound level for a 24-hour day with a 10 decibel penalty applied to noise occurring during the nighttime period, i.e., noise levels occurring during the period from 10:00 p.m. one day until 7:00 a.m. the next are treated as though they were 10 dBA higher than they actually are. The use of the A-weighting is understood. The mathematical expression for L_{dn} is as follows:

$$L_{dn} = 10 \log \frac{1}{24} \left[15 \left(10^{L_d/10} \right) + 9 \left(10^{\frac{L_n + 10}{10}} \right) \right] \text{dBA}$$

Where

L_d = The daytime average sound level

L_n = The nighttime average sound level

D. dBA means abbreviation for the sound level in decibels determined by the A-weighting network of a sound level meter or by calculation from octave band or one-third octave band data.

E. Daytime Hours means 7:00 a.m. to 10:00 p.m., local time.

F. Decibel (dB) means a unit of measure equal to ten times the logarithm to the base ten of the ratio of a particular sound pressure squared to a standard reference pressure squared. For the purpose of this subtitle, 20 micropascals shall be the standard reference pressure.

G. Demolition means any dismantling, destruction or removal activities.

H. Department means the Maryland State Department of Health and Mental Hygiene.

I. Environmental Noise means the noise that exists at any location from all sources.

J. Emergency means any occurrence or set of circumstances involving actual or imminent physical trauma or property damage which demands immediate action.

K. Environmental Noise Standards means the goals for environmental noise, the attainment and maintenance of which, in defined areas and under specified conditions, are necessary to protect the public health and general welfare.

L. Equivalent Sound Level (also Average Sound Level) means the level of a constant sound which, in a given situation and time period, would convey the same sound energy as does the actual time-varying sound during the same period. Equivalent sound level is the level of the time weighted, mean-square, A-weighted sound pressure. A numerical subscript may be used to indicate the time period under consideration, i.e., L_{eq} (24) or L_{eq} (8) for 24-hour and 8-hour periods, respectively. No subscript indicates a 24-hour period. The mathematical expression for the L_{eq} is as follows:

$$L_{eq} = 10 \log_{10} \left[\frac{1}{t_2-t_1} \int_{t_1}^{t_2} 10^{\left(L_A (t)/10\right)} \, dt \right] \text{dBA}$$

Where t_1 and t_2 are the beginning and ending times, respectively, of the period over which the average is determined, the $L_{A(t)}$ is the instantaneous A-weighted sound pressure level fluctuating with time.

M. Nighttime Hours means 10:00 p.m. to 7:00 a.m., local time.

N. Noise means the intensity, frequency, duration and character of sound, including sound and vibration of sub-audible frequencies.

O. Noise Pollution means the presence of noise of sufficient loudness, character and duration, which whether from a single source or multiple sources, is, or may be predicted with reasonable certainty to be injurious to health or which unreasonably interferes with the proper enjoyment of property or with any lawful business or activity.

P. Periodic Noise means noise possessing a repetitive on-and-off characteristic.

Q. Person means any individual, group of individuals, firm, partnership, voluntary association or private, public or municipal corporation or political subdivision of the State, responsible for the use of property.

R. Prominent Discrete Tone means any sound which can be distinctly heard as a single pitch or a set of single pitches. For the purposes of this regulation, a prominent discrete tone shall exist if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by 5 dB for center frequencies of 500 Hz and above and by 8 dB for center frequencies between 160 and 400 Hz and by 15 dB for center frequencies less than or equal to 125 Hz.

S. Sound Level means in decibels, the weighted sound pressure level measured by the use of a sound level meter satisfying the requirements of ANSI S1.4 1971 "Specifications for Sound Level Meters." Sound level and noise level are synonymous. The weighting employed shall always be specified.

T. Sound Level Meter means an instrument, meeting ANSI S1.4 1971 "Specifications for Sound Level Meters," comprising a microphone, an amplifier, an output meter and frequency-weighting network(s) that is used for the measurement of sound pressure levels in a specified manner.

U. Sound Pressure means the minute fluctuations in atmospheric pressure which accompany the passage of a sound wave.

(1) For a steady sound, the value of the sound pressure average over a period of time.

(2) Sound pressure is usually measured in dynes per square centimeter (dyne/cm^2), or in newtons per square meter (N/m^2), or in micropascals.

V. Sound Pressure Level means in decibels, 20 times the logarithm to the base ten of the ratio of a sound pressure to the reference sound pressure of 20 micropascals (20 micronewtons per square meter). In the absence of any modifier, the level is understood to be that of a root-mean-square pressure.

W. Source means any person or property, real or personal, contributing to noise pollution.

X. Vibration means any oscillatory motion of solid bodies.

Y. Zoning District means a general land use category, defined according to local subdivision, the activities and uses for which are generally uniform throughout the subdivision. For the purposes of this regulation, property which is not zoned Residential, Commercial or Industrial shall be classified according to use as follows:

(1) Commercial means property used for buying and selling goods and services.

(2) Industrial means property used for manufacturing and storing goods.

(3) Residential means property used for dwellings.

.02 Environmental Noise Standards

A. Precepts

(1) It is known that noise above certain levels is harmful to the health of humans. Although precise levels at which all adverse health effects occur have not definitely been ascertained, it is known that one's well-being can be affected by noise through loss of sleep, speech interference, hearing impairment and a variety of other psychological and physiological factors. The establishment of ambient noise standards or goals must provide margins of safety in reaching conclusions based on available data which relate noise exposure to health and welfare effects, with due consideration to technical and economic factors.

(2) The environmental noise standards set forth here represent goals expressed in terms of equivalent A-weighted sound levels which are protective of the public health and welfare. The ambient noise levels shall be achieved through application, under provisions of laws or regulations or otherwise, of means for reducing noise levels including, but not limited to, isolation of noise producing equipment, dampening of sound waves by insulation, equipment modification and redesign, and land use management.

B. Standards for Environmental Noise

General - The following sound levels represent the standards for the State by general zoning district:

Table 1

Environmental Noise Standards

Zoning District	Level	Measure
Industrial	70 dBA	L_{eq} (24)
Commercial	64 dBA	L_{dn}
Residential	55 dBA	L_{dn}

.03 General Regulations

A. Noise and Vibration Prohibitions

(1) A person may not cause or permit noise levels which exceed those specified in Table 2 except as provided in § A(2), A(3) or B, below.

Table 2

Maximum Allowable Noise Levels by Zoning Category (dBA)

Effective Date	Day/Night	Industrial	Commercial	Residential
September 14, 1977	Day	80	72	65
	Night	80	67	55
January 1, 1980	Day	75	67	60
	Night	75	62	50

(2) A person may not cause or permit noise levels emanating from construction or demolition site activities which exceed:

(a) 90 dBA during daytime hours;

(b) The levels specified in Table 2 during nighttime hours.

(3) A person may not cause or permit the emission of prominent discrete tones and periodic noises which exceed a level which is 5 dBA lower than the applicable level listed in Table 2.

(4) A person may not cause or permit, beyond the property line of a source, vibration of sufficient intensity to cause another person to be aware of the vibration by such direct means as sensation of touch or visual observation of moving objects. The observer shall be located at or within the property line of the receiving property when vibration determinations are made.

B. Exemptions

(1) The provisions of this section may not apply to devices used solely for the purpose of warning, protecting, or alerting the public, or some segment thereof, of the existence of an emergency situation.

(2) The provisions of this section may not apply to the following:

(a) Household tools and portable appliances in normal usage.

(b) Lawn care and snow removal equipment (daytime only) when used and maintained in accordance with the manufacturer's specifications.

(c) Agricultural field machinery when used and maintained in accordance with manufacturer's specifications.

(d) Blasting operations for demolition, construction, and mining or quarrying (daytime only).

(e) Motor vehicles on public roads.

(f) Aircraft.

(g) Motor vehicles or boats on State lands or waters.

(h) Emergency utility operations.

(i) Pile driving equipment during the daytime hours of 8:00 a.m. to 5:00 p.m.

(j) Sound not electronically amplified created by sporting, amusement, and entertainment events, and other public gatherings operating according to terms and conditions of appropriate local jurisdictional body. This includes, but is not limited to, athletic contests, amusement parks, carnivals, fairgrounds, sanctioned auto racing facilities, parades and public celebrations.

(k) Rapid-rail transit vehicles and railroads.

C. Variance Procedure

(1) Any person who believes that meeting the requirements of A, above is not practical in a particular case may request an exception to its requirements.

(2) Requests submitted to the Department shall be in writing and shall include evidence to show that compliance is not practical.

(3) Upon receipt of a request for an exception, the Department shall schedule a hearing to be held within 60 days.

(4) The applicant for the exception, at least 30 days before the hearing date, shall advertise prominently the hearing by placing a notice in a newspaper of general circulation in the subdivision in which the facility or source for which the exception is sought is located. The notice shall include the name of the facility or source and such additional information as the Department may require. Based upon evidence presented at the

hearing, the Secretary may grant an exception to A, above for a period not to exceed 5 years under terms and conditions appropriate to reduce the impact of the exception.

(5) Exceptions shall be renewable upon receipt by the Department of evidence that conditions under which the exception was originally granted have not changed significantly.

D. Measurement

(1) The equipment and techniques employed in the measurement of noise levels may be those recommended by the Department, which may refer to currently accepted standards or recognized organizations, including, but not limited to, the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), Society of Automotive Engineers (SAE), and the United State Environmental Protection Agency (EPA).

(2) The measurement of noise levels shall be conducted at points on or within the property line of the receiving property or the boundary of a zoning district, and may be conducted at any point for the determination of identity in multiple source situations.

(3) Sound level meters used to determine compliance with Section .03A shall meet the specifications of the American National Standards Institute or its successor bodies ANSI S1.4 - 1971 for Type II sound level meters.

.04 Emission Regulations

Reserved for future promulgation.

.05 Penalties

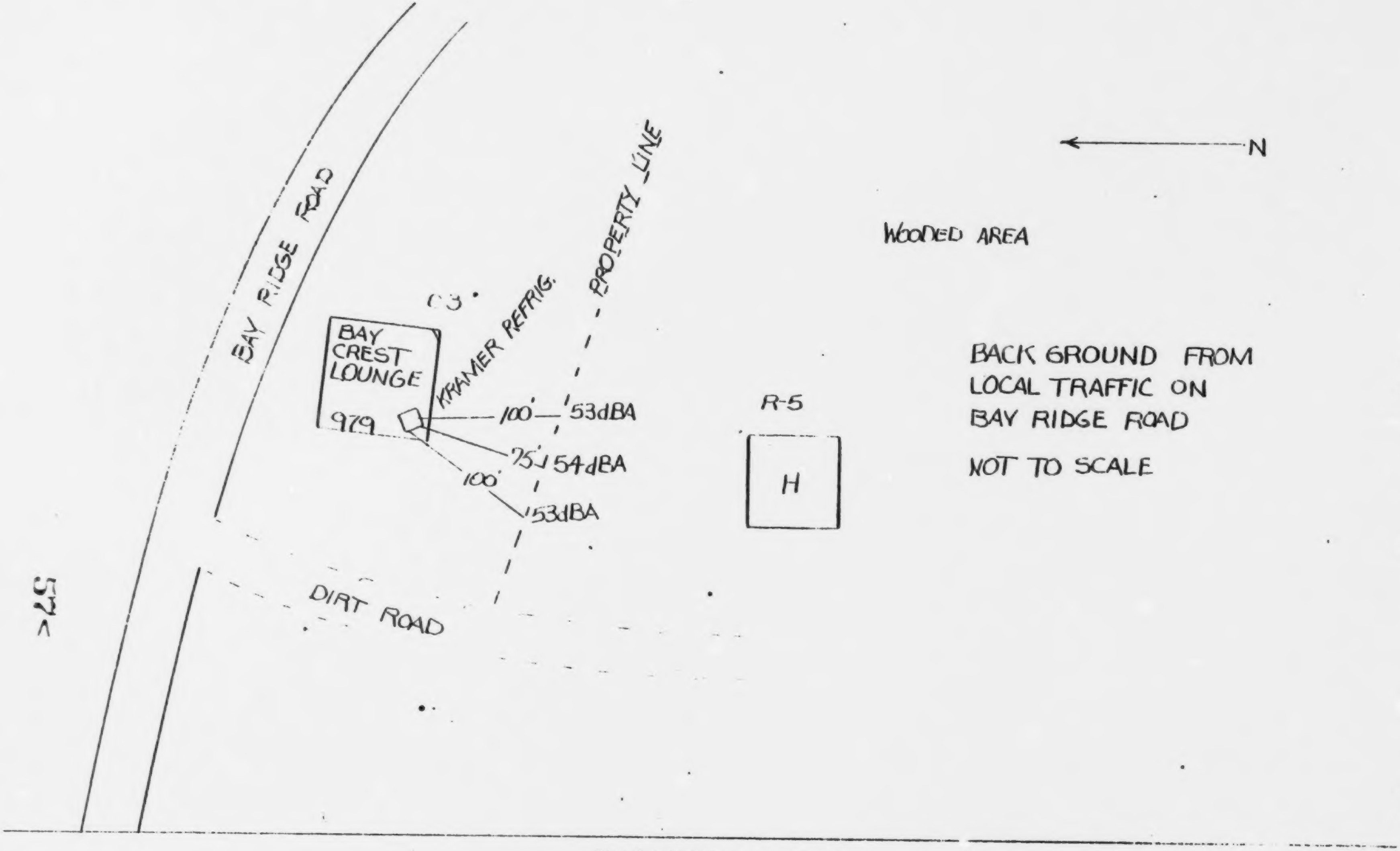
A. Civil Penalty. Any person who willfully violates these regulations shall be liable to a civil penalty of not more than $10,000. Each day during which a violation continues there shall be a liability for a separate penalty.

B. Plan for Compliance. A violator who has submitted a Plan for Compliance with these regulations and has that Plan, or amendments to it approved by the Secretary upon recommendation of the Department, shall not be considered to be in violation of these regulations as long as he acts in accordance with the original or amended Plan.

Effective: August 6, 1975
Amended: September 14, 1977

Appendix 2

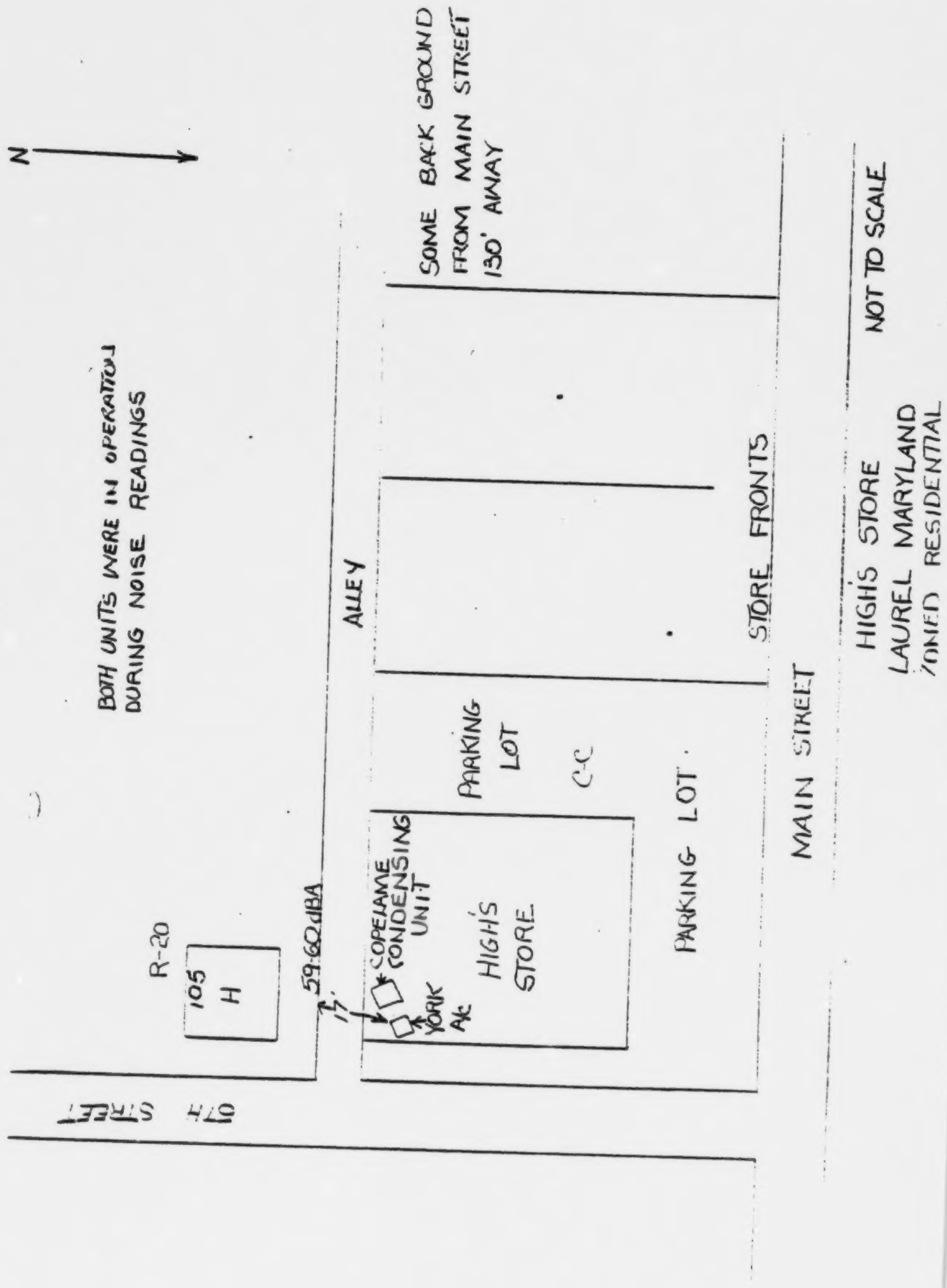
Location Site Sketches and Noise Survey Results:

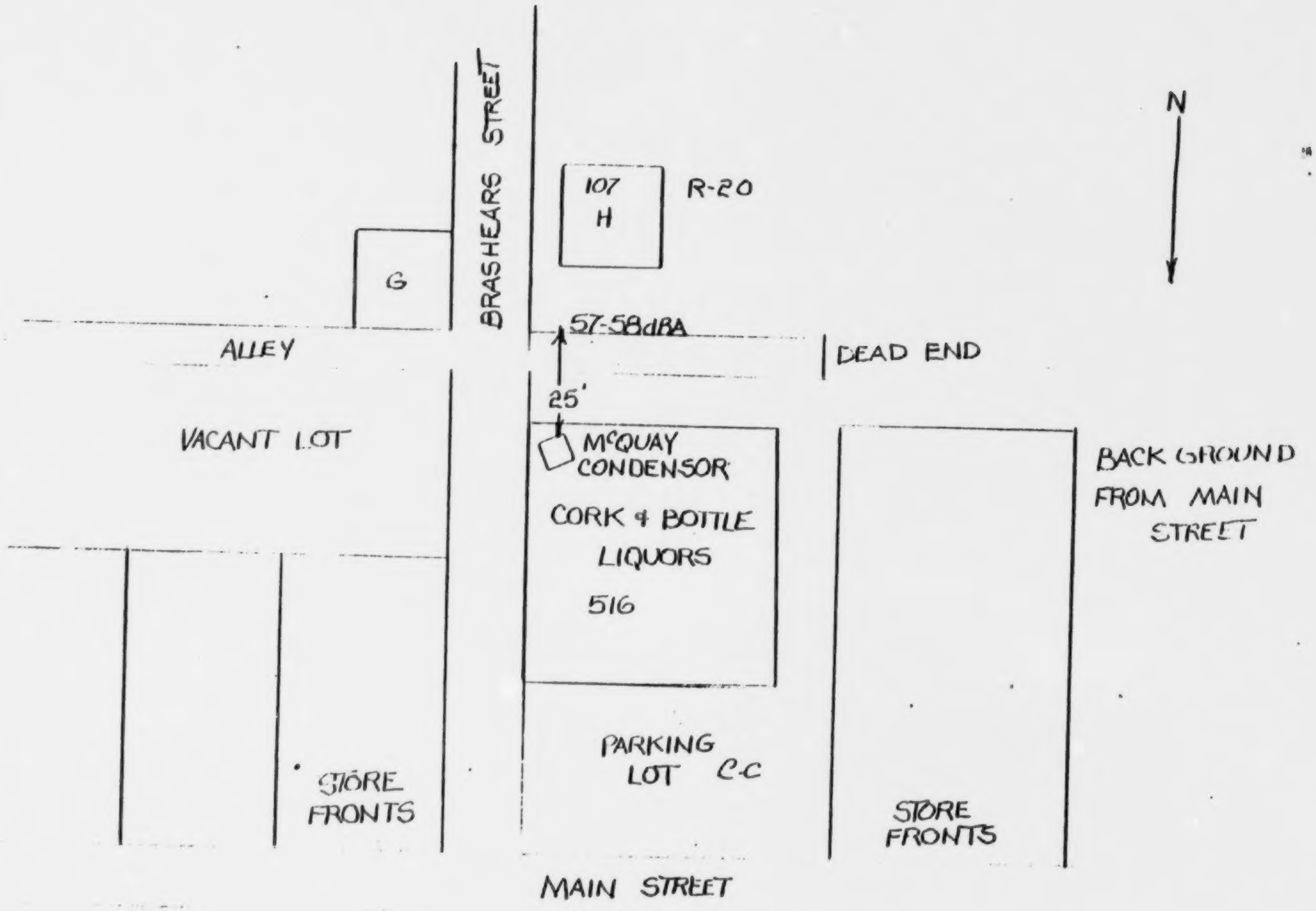

BAY RIDGE ROAD
BAY CREST LOUNGE
979
C3
KRAMER REFRIG.
PROPERTY LINE
100'
53dBA
75'
54dBA
100'
53dBA
DIRT ROAD
R-5
H
N
WOODED AREA

BACK GROUND FROM
LOCAL TRAFFIC ON
BAY RIDGE ROAD

NOT TO SCALE

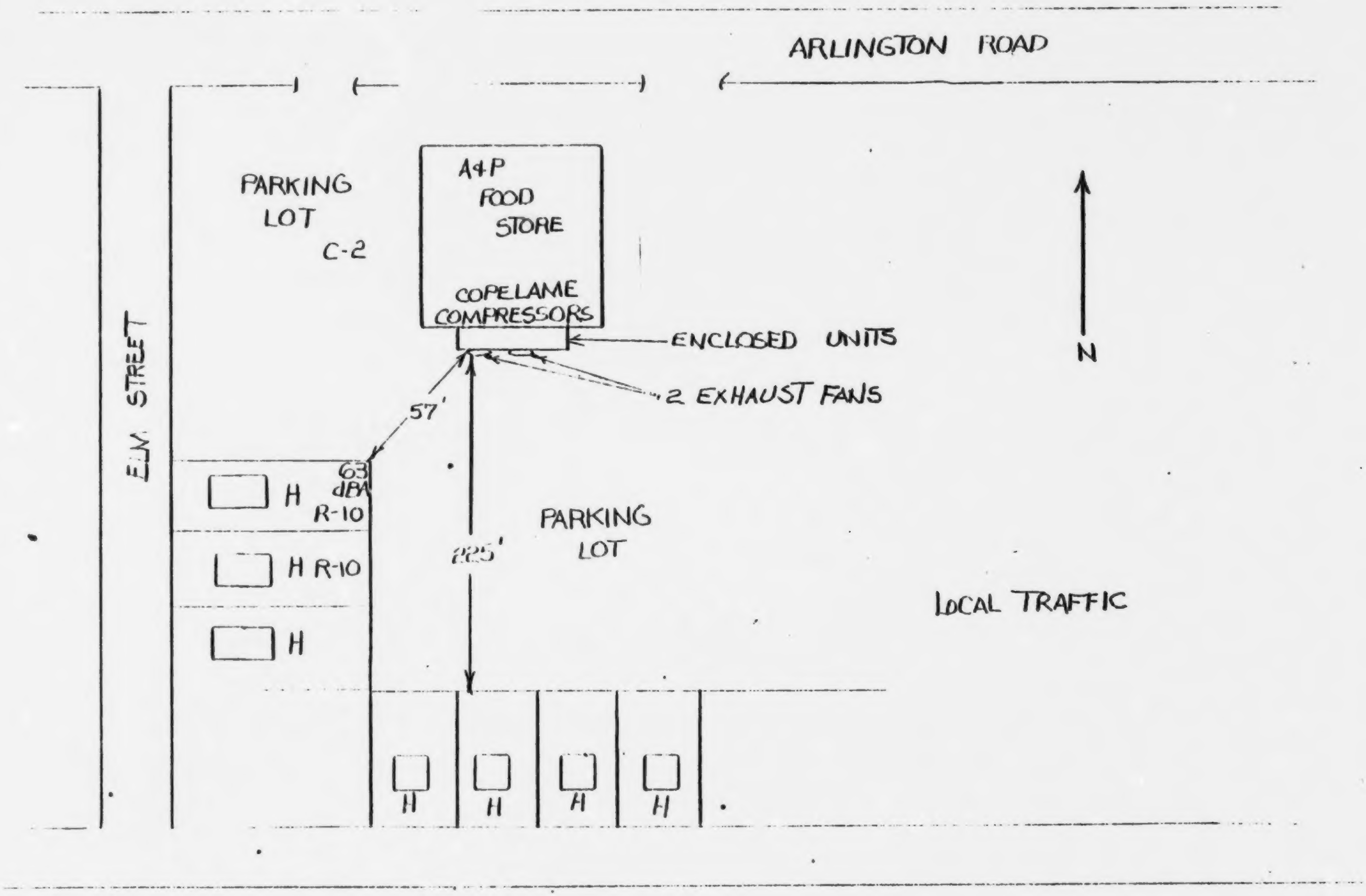
BAY CREST LOUNGE
ANNE ARUNDEL COUNTY
ZONED RESIDENTIAL


BOTH UNITS WERE IN OPERATION
DURING NOISE READINGS
N
SOME BACK GROUND
FROM MAIN STREET
130' AWAY
ALLEY
PARKING
LOT
C-C
PARKING LOT
STORE FRONTS
MAIN STREET
HIGH'S STORE
LAUREL MARYLAND
ZONED RESIDENTIAL
NOT TO SCALE
R-20
105
H
59-60 dBA
17'
COPELAME
CONDENSING
UNIT
YORK
AC
HIGH'S
STORE
6TH STREET


N
BRASHEARS STREET
107
H
R-20
G
57-58dBA
ALLEY
DEAD END
25'
VACANT LOT
McQUAY CONDENSOR
CORK & BOTTLE LIQUORS
516
BACK GROUND FROM MAIN STREET
PARKING LOT C-C
STORE FRONTS
STORE FRONTS
MAIN STREET

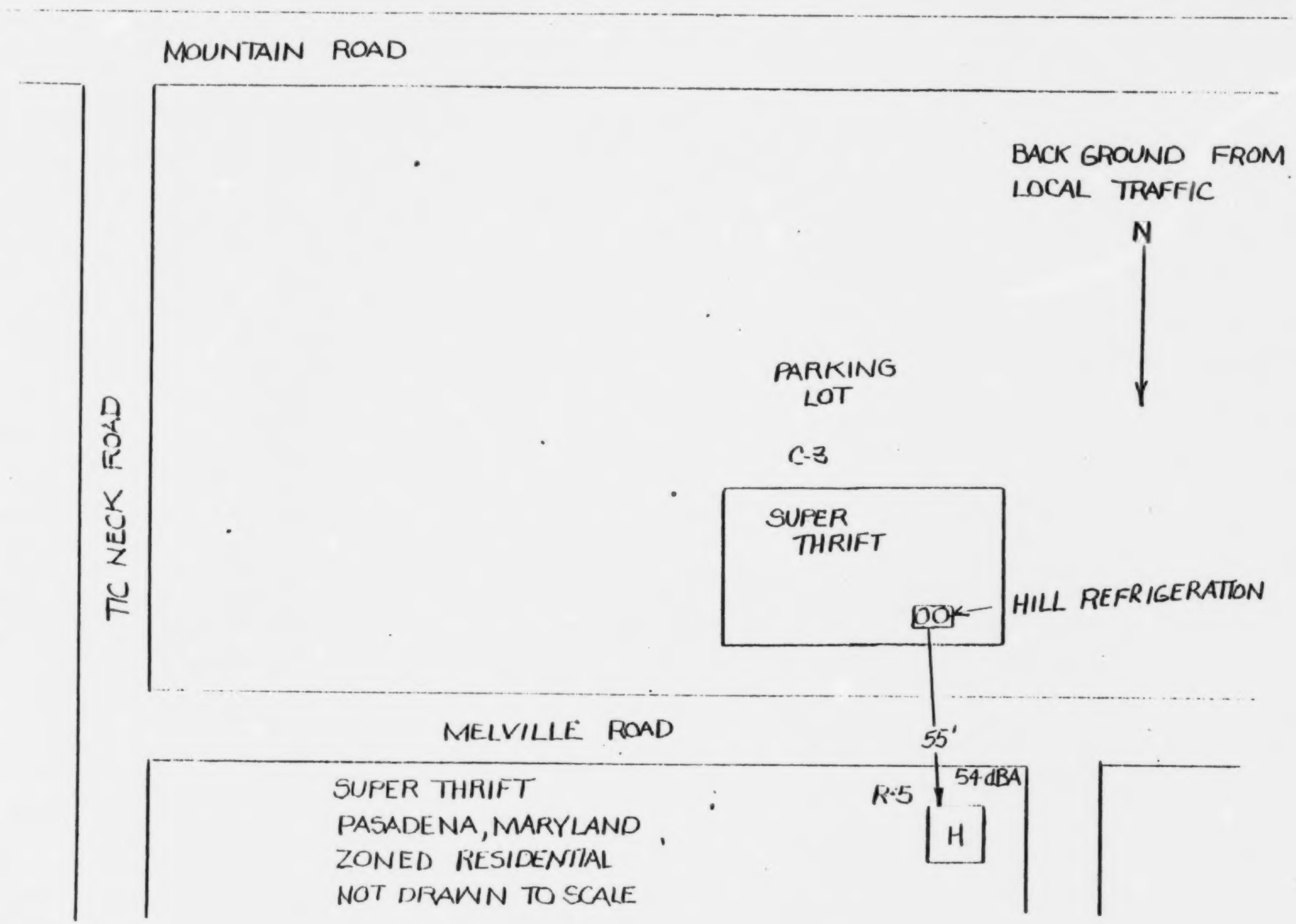
CORK & BOTTLE LIQUOR'S
LAUREL MARYLAND
ZONED RESIDENTIAL

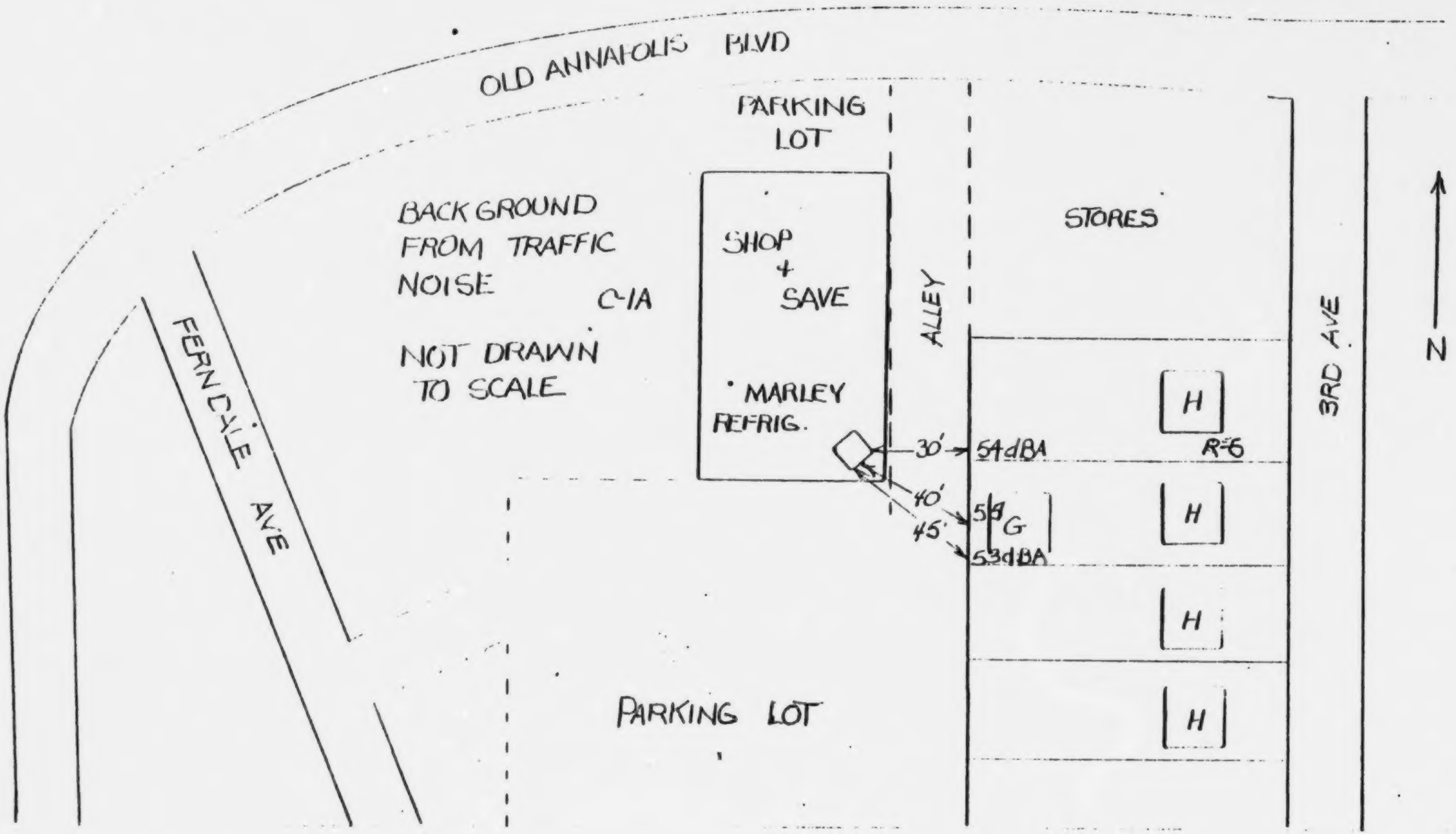
NOT TO SCALE


ARLINGTON ROAD
PARKING LOT
C-2
A&P FOOD STORE
COPELAME COMPRESSORS
ENCLOSED UNITS
2 EXHAUST FANS
N
ELM STREET
57'
63 dBA
R-10
H
H R-10
H
225'
PARKING LOT
LOCAL TRAFFIC
H
H
H
H

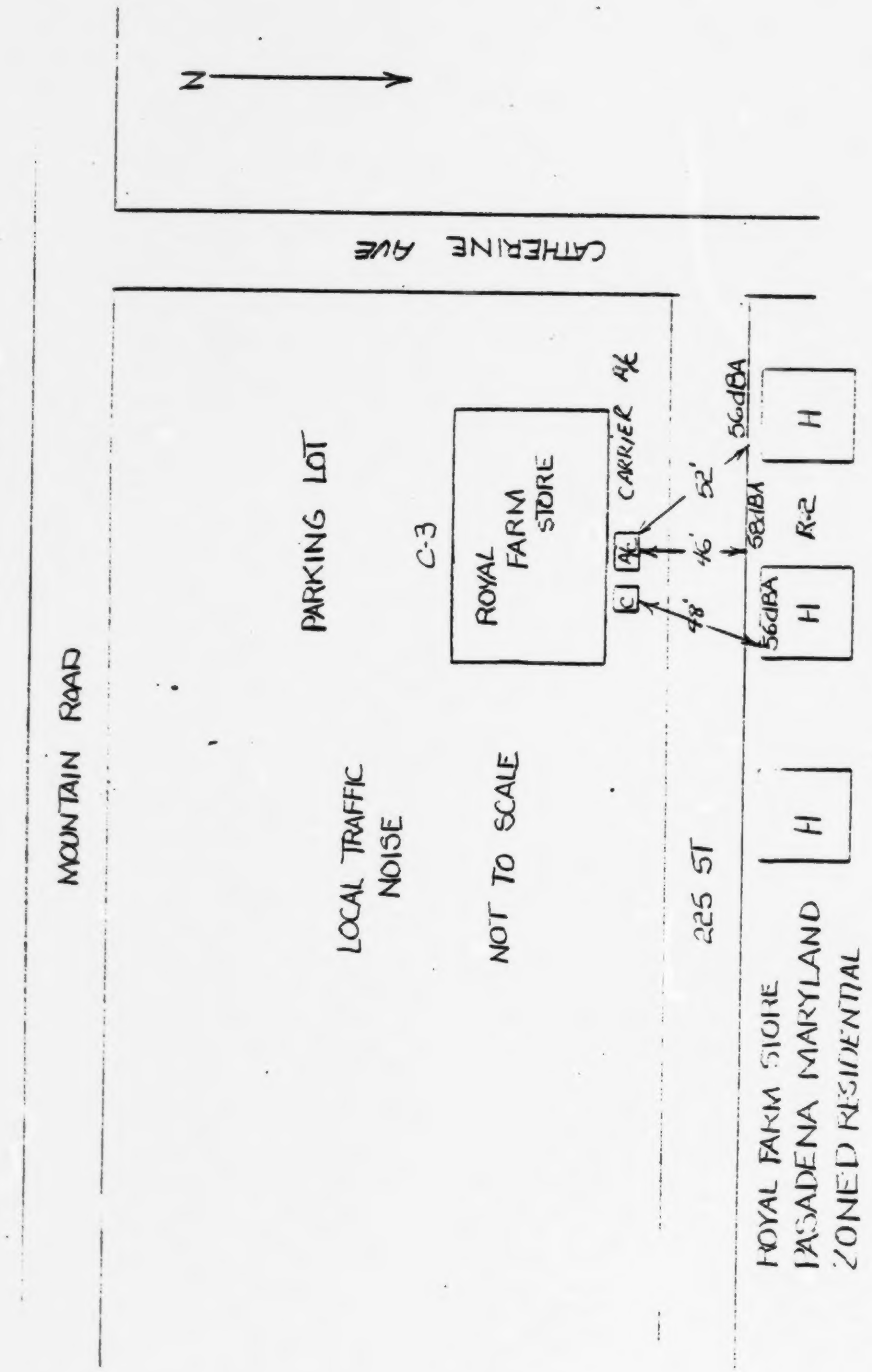
A & P FOOD STORE
BETHESDA MARYLAND
ZONED RESIDENTIAL

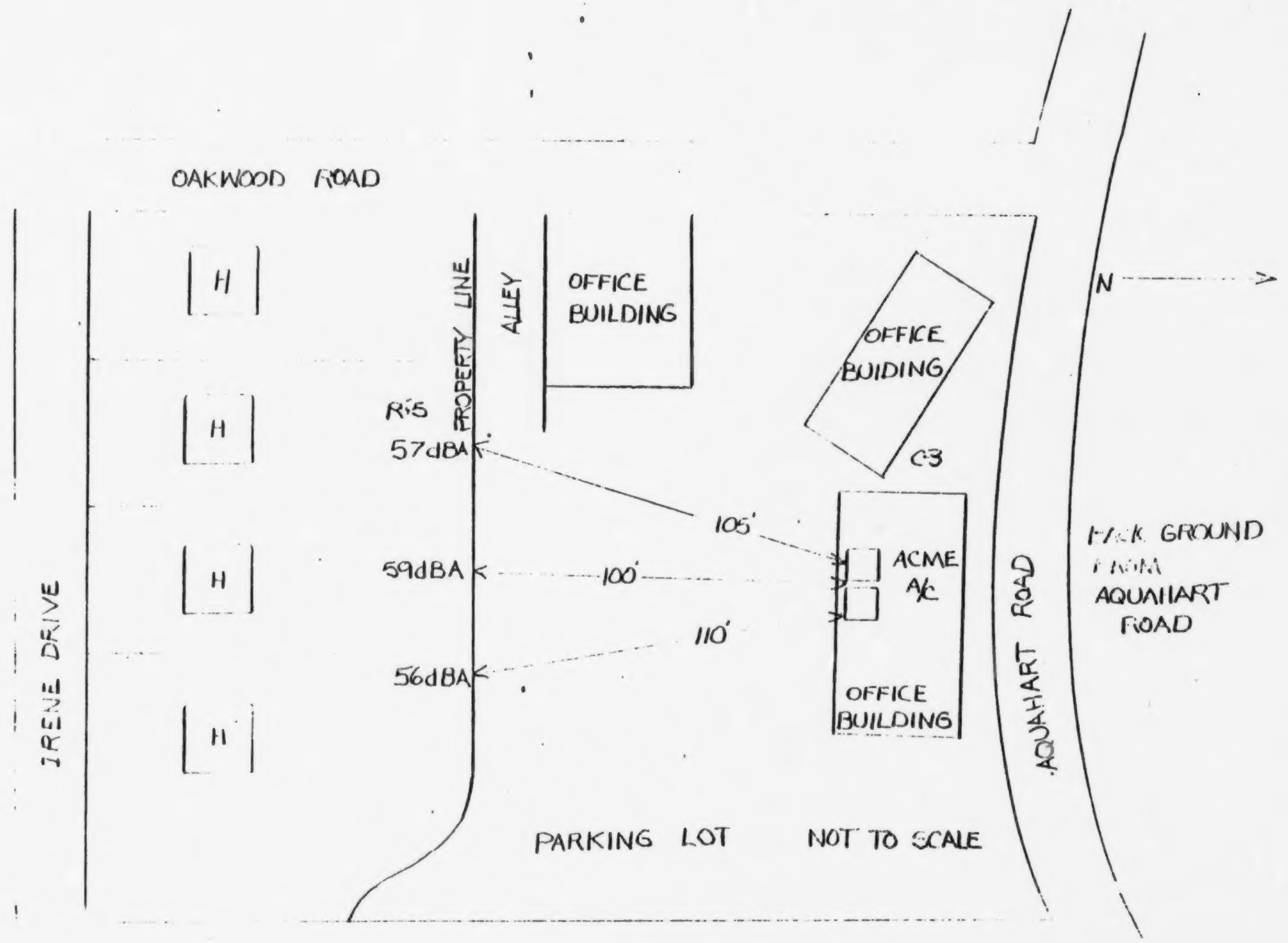
NOT TO SCALE


MOUNTAIN ROAD
BACK GROUND FROM
LOCAL TRAFFIC
N
PARKING
LOT
C-3
SUPER
THRIFT
HILL REFRIGERATION
TIC NECK ROAD
MELVILLE ROAD
55'
54 dBA
R-5
H
SUPER THRIFT
PASADENA, MARYLAND
ZONED RESIDENTIAL
NOT DRAWN TO SCALE

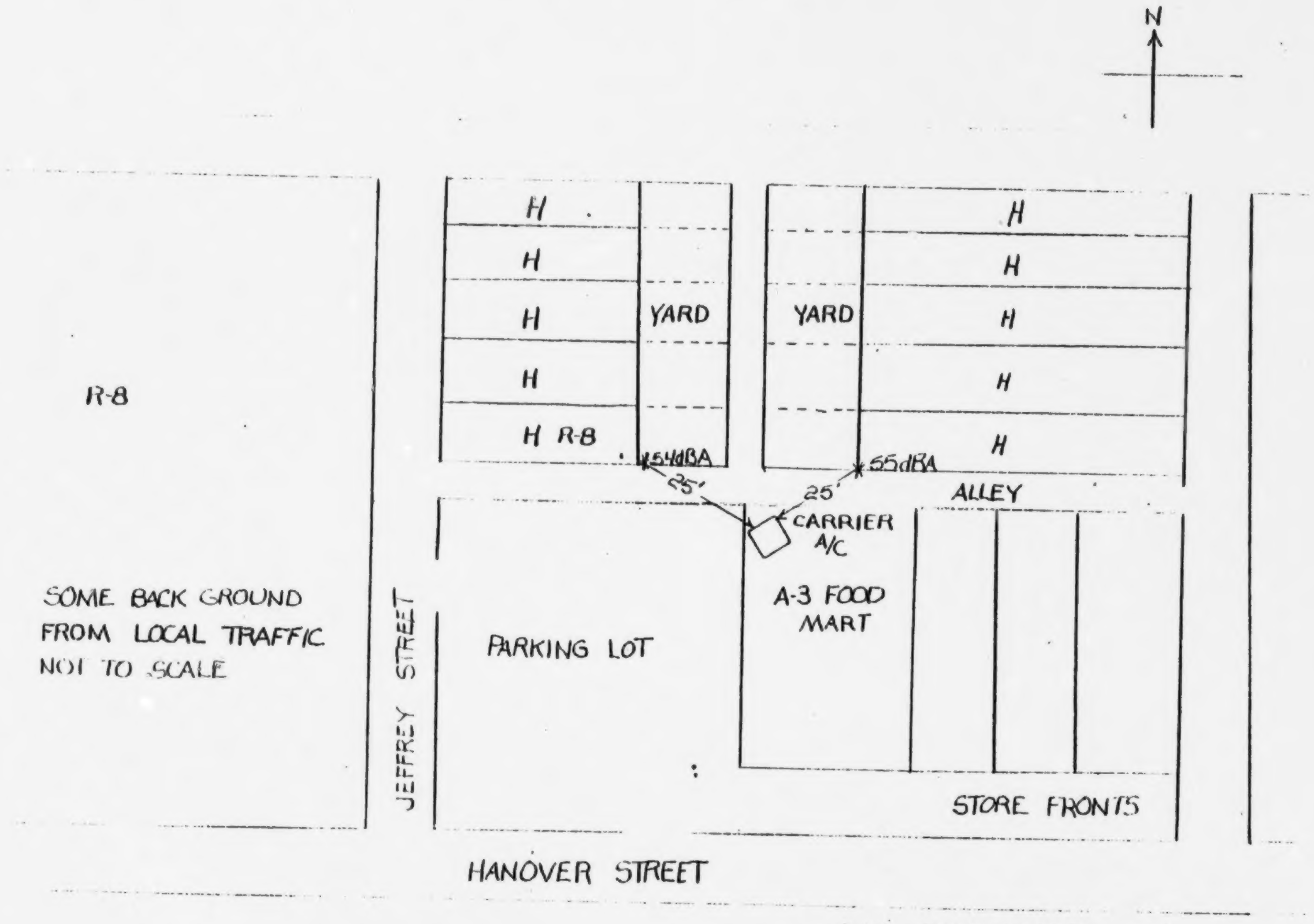

OLD ANNAPOLIS BLVD
PARKING LOT
SHOP + SAVE
MARLEY REFRIG.
BACK GROUND FROM TRAFFIC NOISE
C-1A
NOT DRAWN TO SCALE
ALLEY
STORES
3RD AVE
N
H
H
H
H
R-6
G
30'
54dBA
40'
58
45'
53dBA
FERNDALE AVE
PARKING LOT

SHOP + SAVE
FERNDALE MARYLAND
ZONED RESDENTIAL

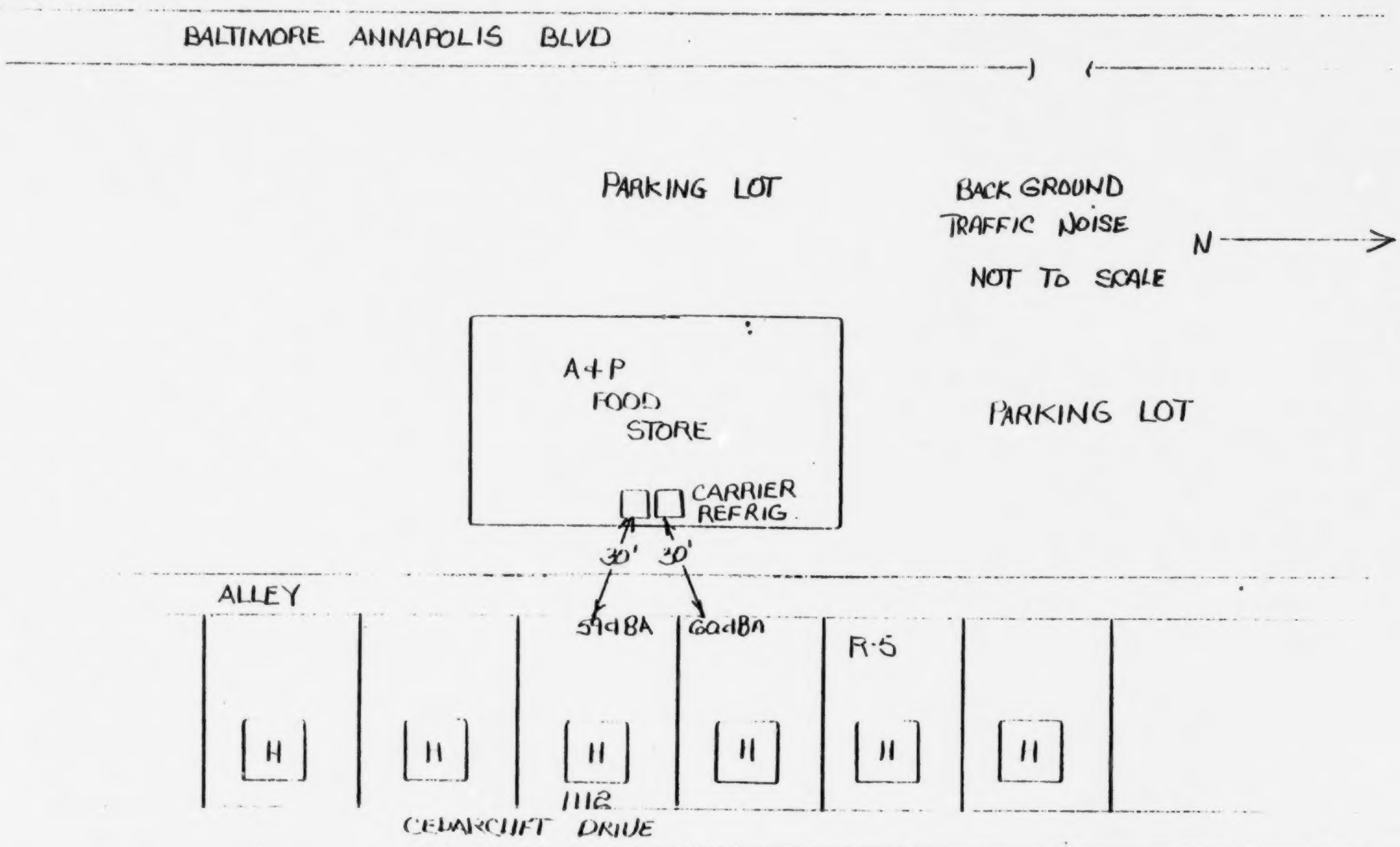

N
CATHERINE AVE
MOUNTAIN ROAD
PARKING LOT
C-3
ROYAL FARM STORE
C
AC
CARRIER AC
48'
46'
52'
56dBA
58dBA
56dBA
R-2
H
H
H
LOCAL TRAFFIC NOISE
NOT TO SCALE
225 ST
ROYAL FARM STORE
PASADENA MARYLAND
ZONED RESIDENTIAL


OAKWOOD ROAD
IRENE DRIVE
H
H
H
H
PROPERTY LINE
ALLEY
OFFICE BUILDING
OFFICE BUILDING
C3
ACME A/C
OFFICE BUILDING
R-5
57dBA
59dBA
56dBA
105'
100'
110'
AQUAHART ROAD
N
BACK GROUND FROM AQUAHART ROAD
PARKING LOT
NOT TO SCALE

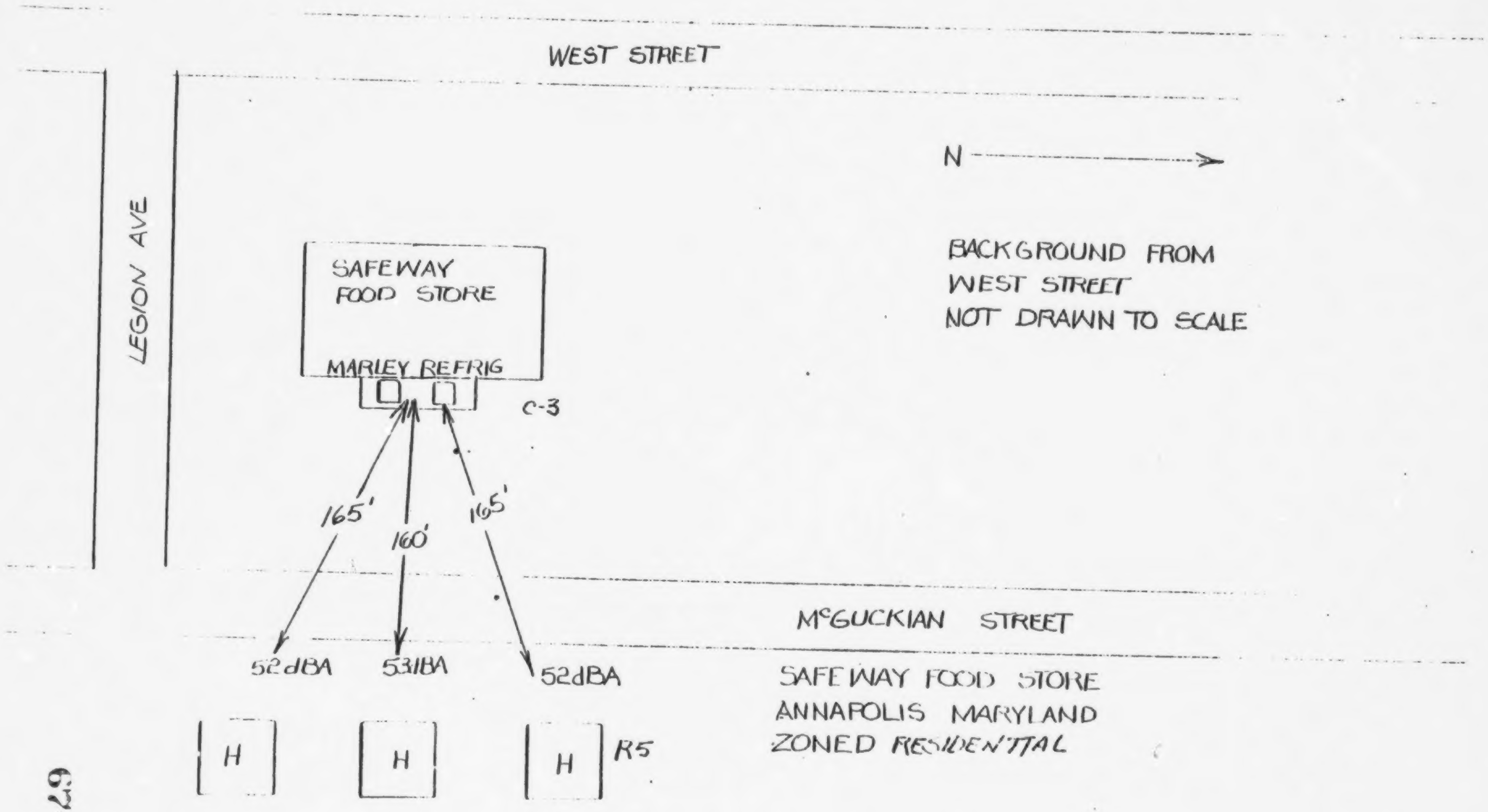
AQUAHART 91 OFFICE BUILDING
HARUNDALE MARYLAND
ZONED RESIDENTIAL

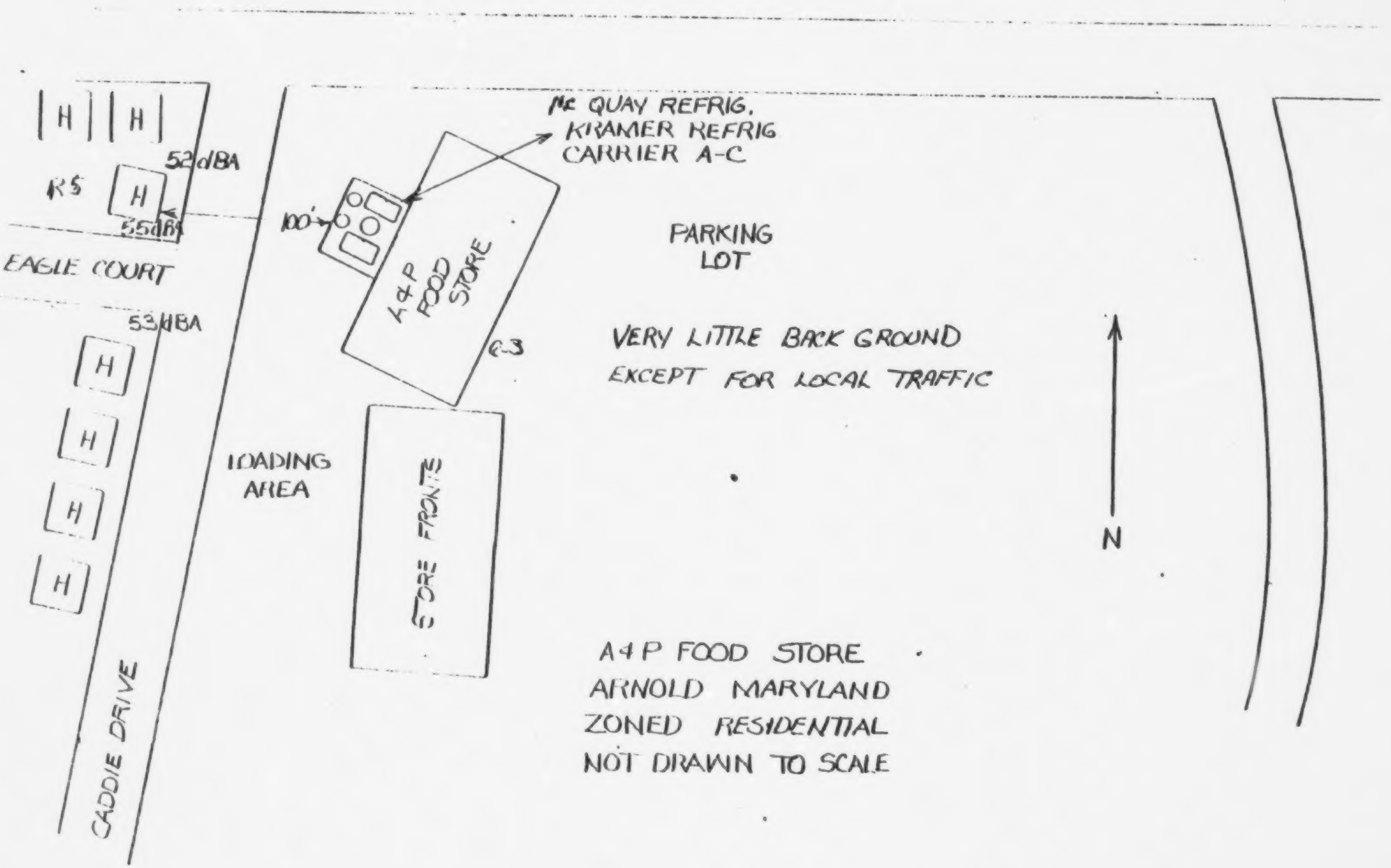

N
R-8
H
H
H
H
H R-8
YARD
YARD
H
H
H
H
H
54dBA
55dBA
25'
25'
ALLEY
CARRIER A/C
A-3 FOOD MART
PARKING LOT
STORE FRONTS
JEFFREY STREET
HANOVER STREET
SOME BACK GROUND
FROM LOCAL TRAFFIC
NOT TO SCALE

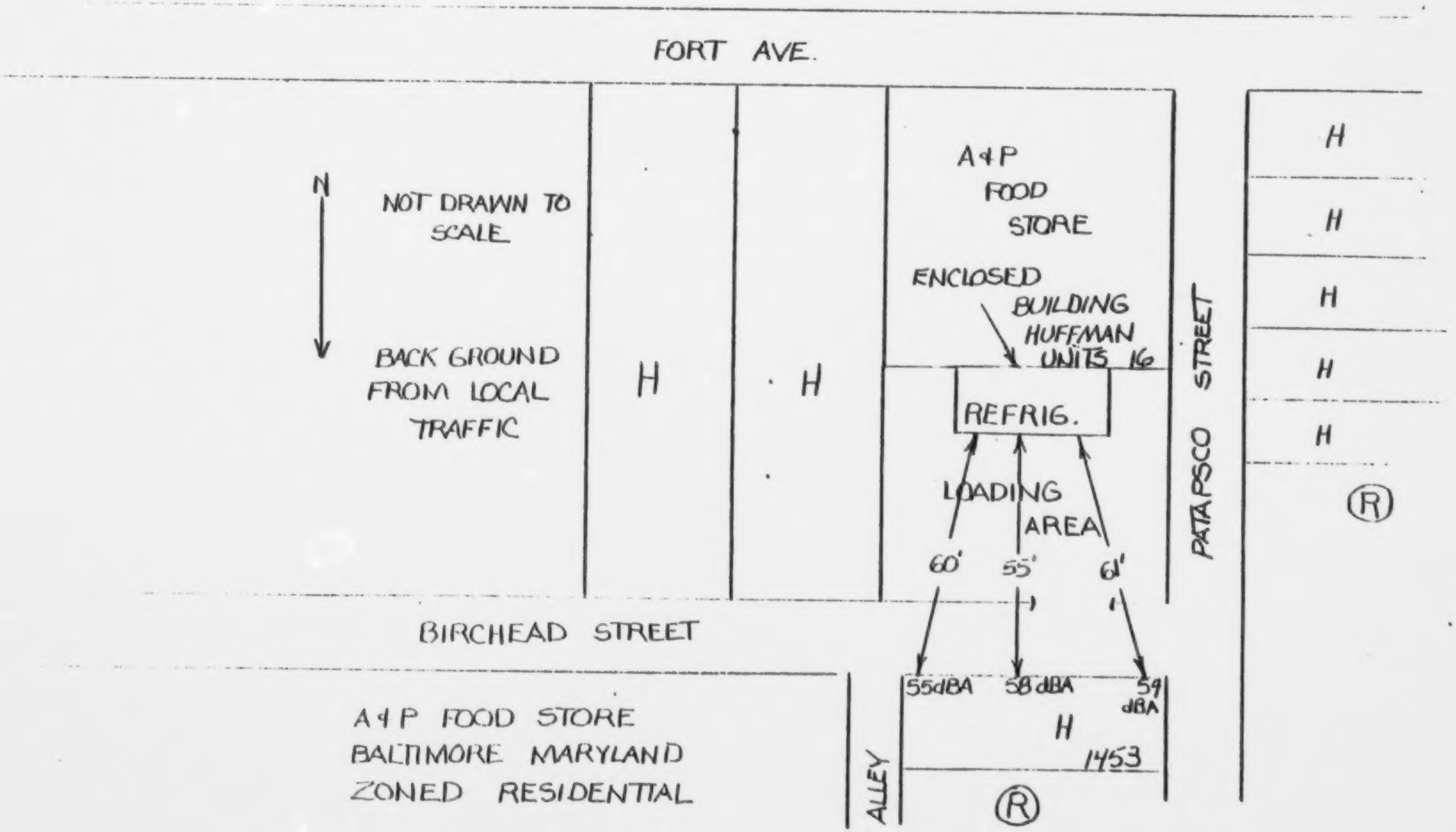
A-3 FOOD MART
BALTIMORE, MARYLAND
ZONED RESIDENTIAL

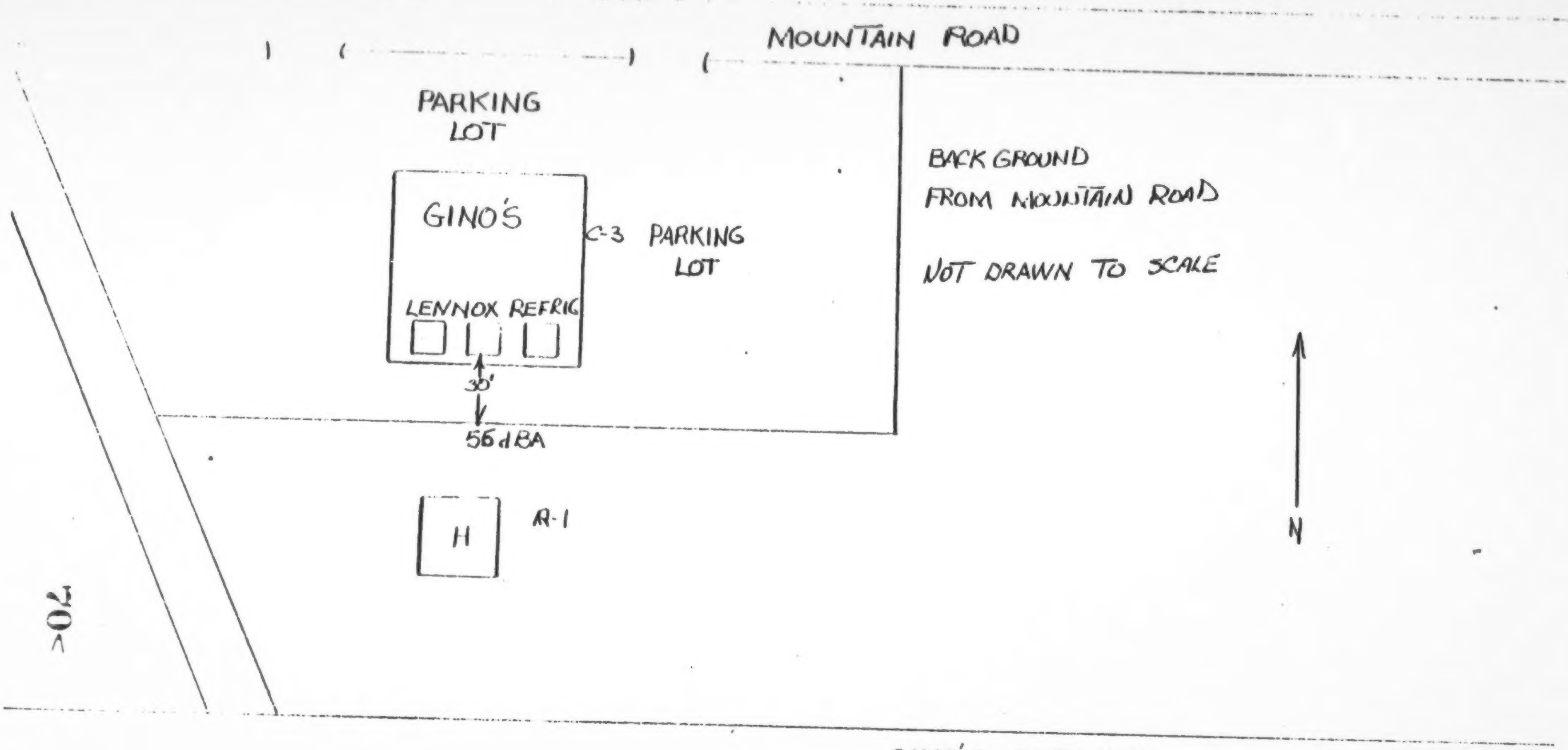

BALTIMORE ANNAPOLIS BLVD
PARKING LOT
BACK GROUND
TRAFFIC NOISE
N
NOT TO SCALE
A+P
FOOD
STORE
PARKING LOT
CARRIER
REFRIG.
30'
30'
ALLEY
59dBA
60dBA
R-5
H
11
11
11
11
11
1112
CEDARCLIFF DRIVE

A+P FOOD STORE
SUNVALLEY MARYLAND
ZONED RESIDENTIAL


WEST STREET
LEGION AVE
N
BACKGROUND FROM
WEST STREET
NOT DRAWN TO SCALE
SAFEWAY
FOOD STORE
MARLEY REFRIG
C-3
165'
160'
165'
McGUCKIAN STREET
52dBA
53dBA
52dBA
H
H
H
R5
SAFEWAY FOOD STORE
ANNAPOLIS MARYLAND
ZONED RESIDENTIAL


H
H
52 dBA
R5
H
55 dBA
EAGLE COURT
53 dBA
H
H
H
H
CADDIE DRIVE
LOADING AREA
100'
A & P FOOD STORE
C-3
STORE FRONTS
Mc QUAY REFRIG.
KRAMER REFRIG
CARRIER A-C
PARKING LOT
VERY LITTLE BACK GROUND
EXCEPT FOR LOCAL TRAFFIC
N
A & P FOOD STORE
ARNOLD MARYLAND
ZONED RESIDENTIAL
NOT DRAWN TO SCALE

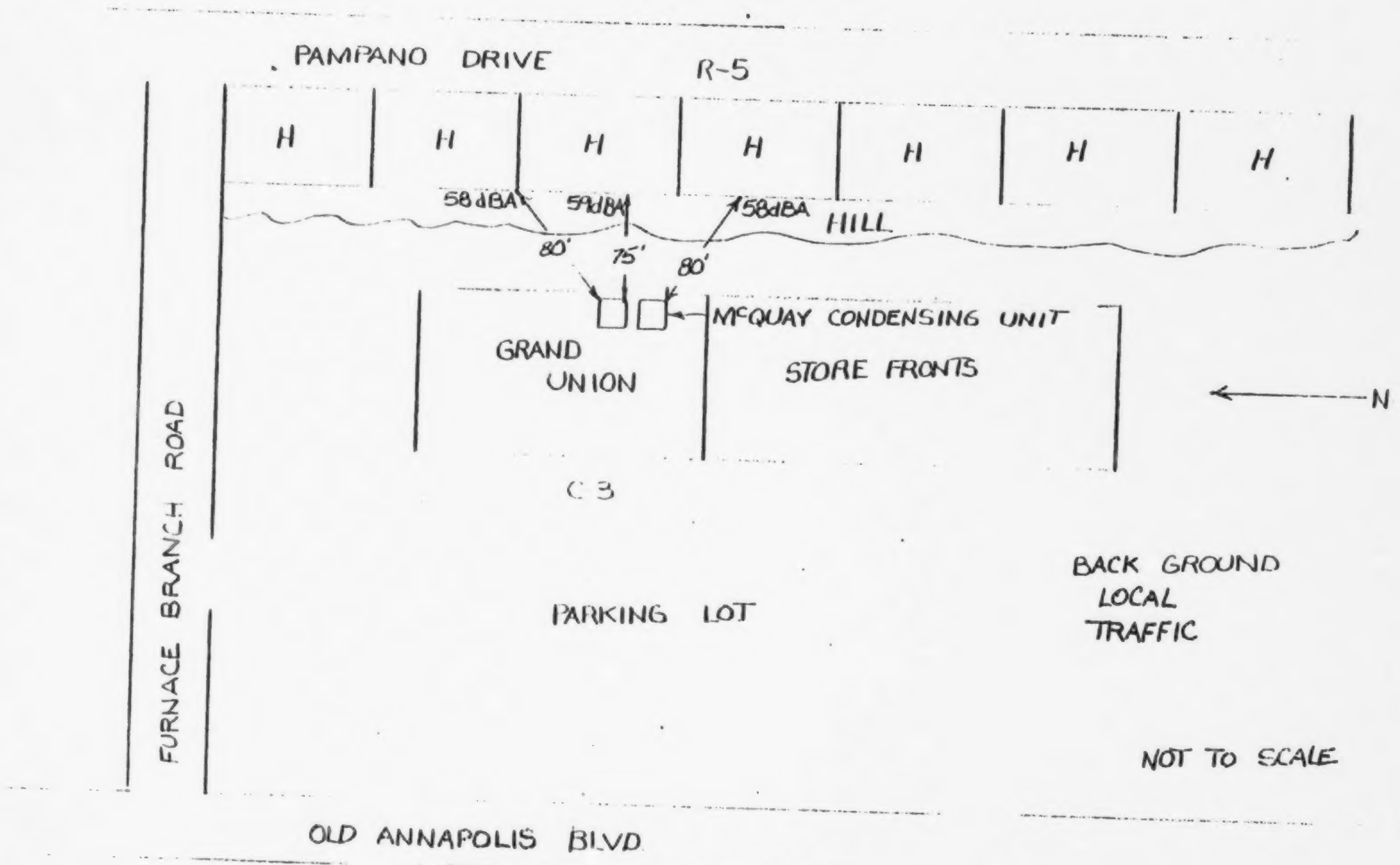

FORT AVE.
N
NOT DRAWN TO SCALE
BACK GROUND FROM LOCAL TRAFFIC
H
H
A&P FOOD STORE
ENCLOSED BUILDING HUFFMAN UNITS 16
REFRIG.
LOADING AREA
60'
55'
61'
PATAPSCO STREET
H
H
H
H
H
R
BIRCHEAD STREET
55dBA
58dBA
59 dBA
H
1453
ALLEY
R
A&P FOOD STORE
BALTIMORE MARYLAND
ZONED RESIDENTIAL


MOUNTAIN ROAD
PARKING LOT
GINO'S
C-3
PARKING LOT
LENNOX REFRIG
30'
56 dBA
H
R-1
N

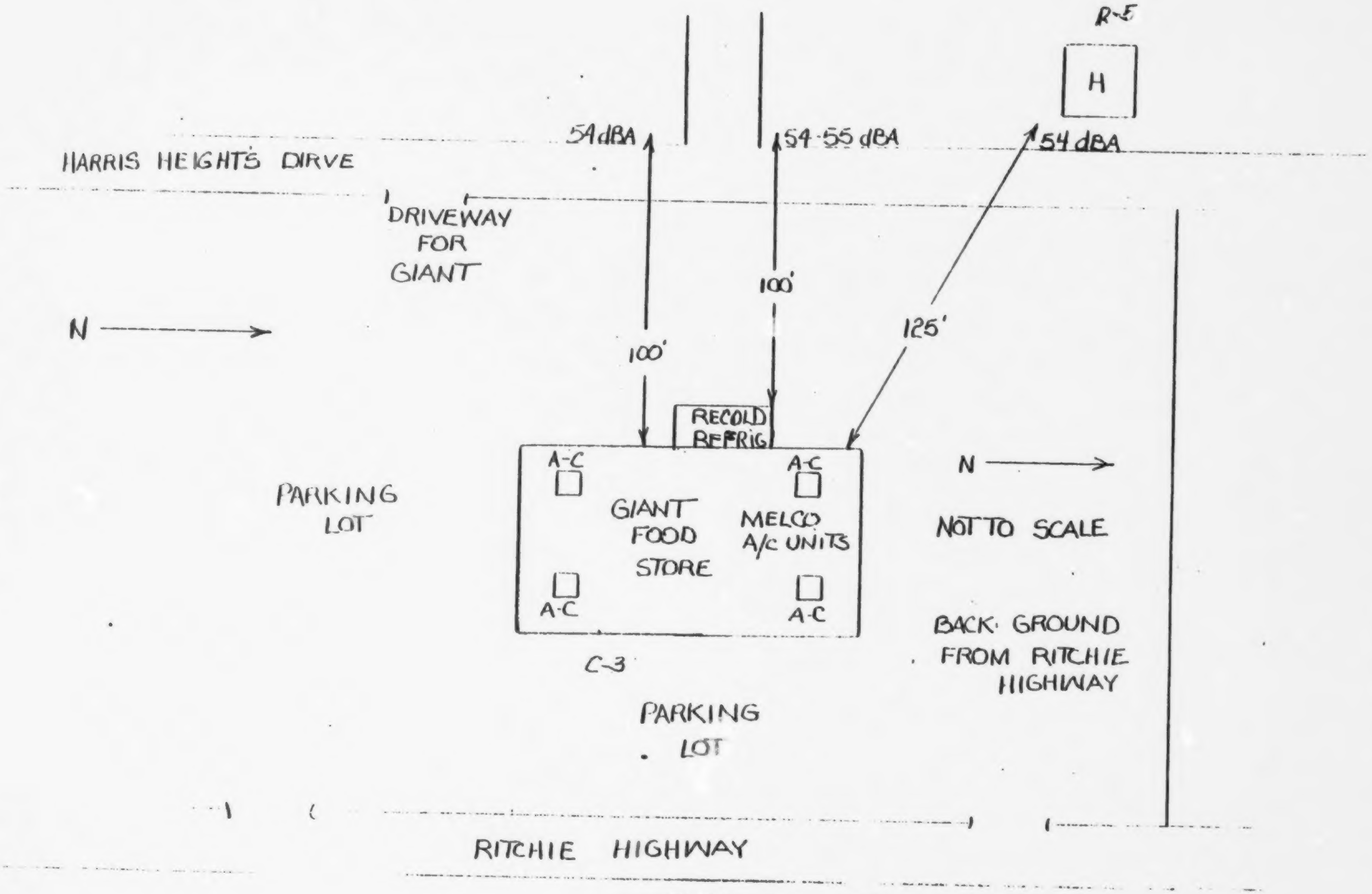
BACK GROUND
FROM MOUNTAIN ROAD

NOT DRAWN TO SCALE

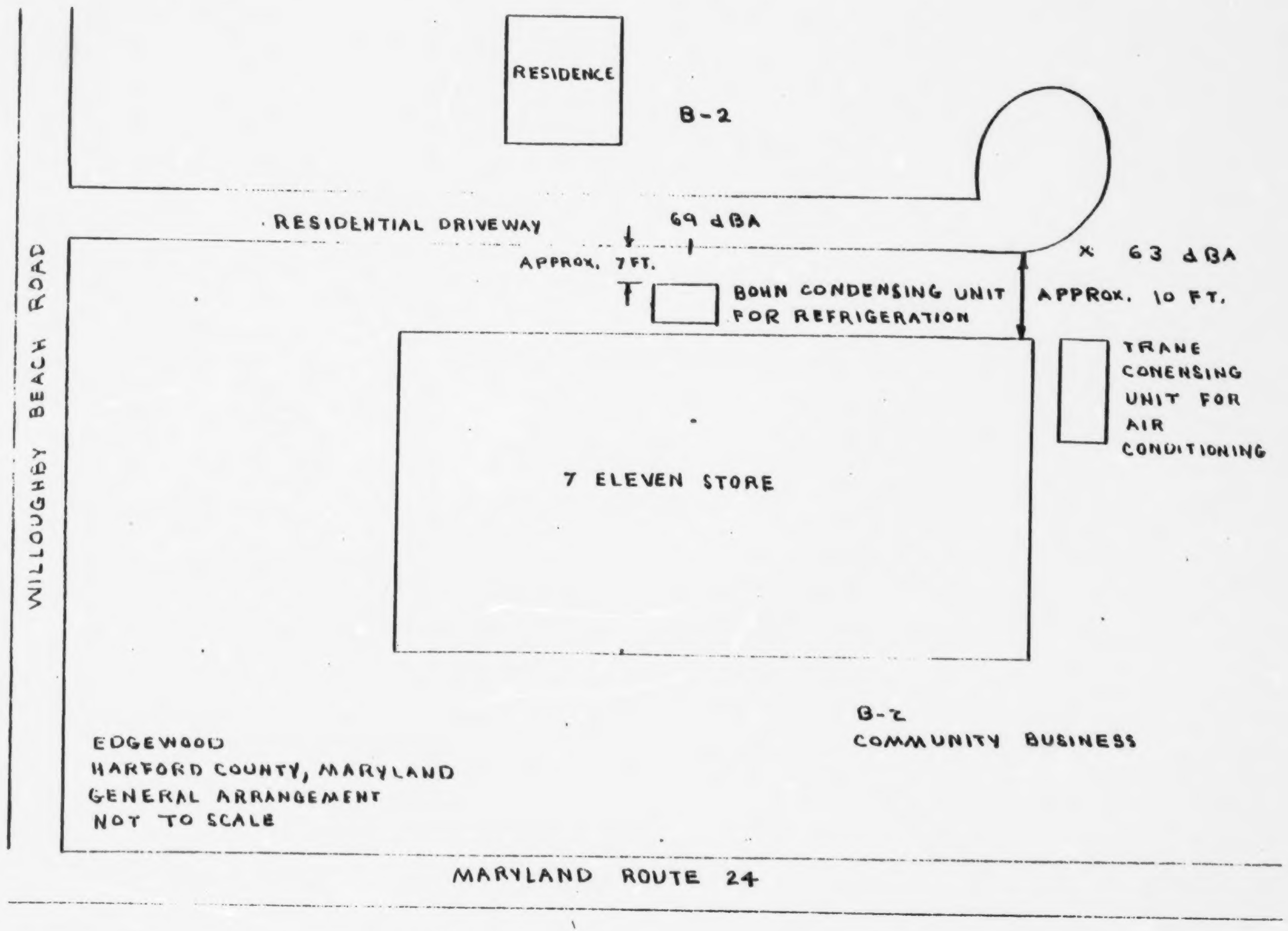
GINO'S FAST FOOD
SUNVALLEY MARYLAND
ZONED RESIDENTIAL


PAMPANO DRIVE
R-5
H
H
H
H
H
H
H
58dBA
59dBA
58dBA
HILL
80'
75'
80'
McQUAY CONDENSING UNIT
GRAND UNION
STORE FRONTS
N
C 3
FURNACE BRANCH ROAD
PARKING LOT
BACK GROUND LOCAL TRAFFIC
NOT TO SCALE
OLD ANNAPOLIS BLVD

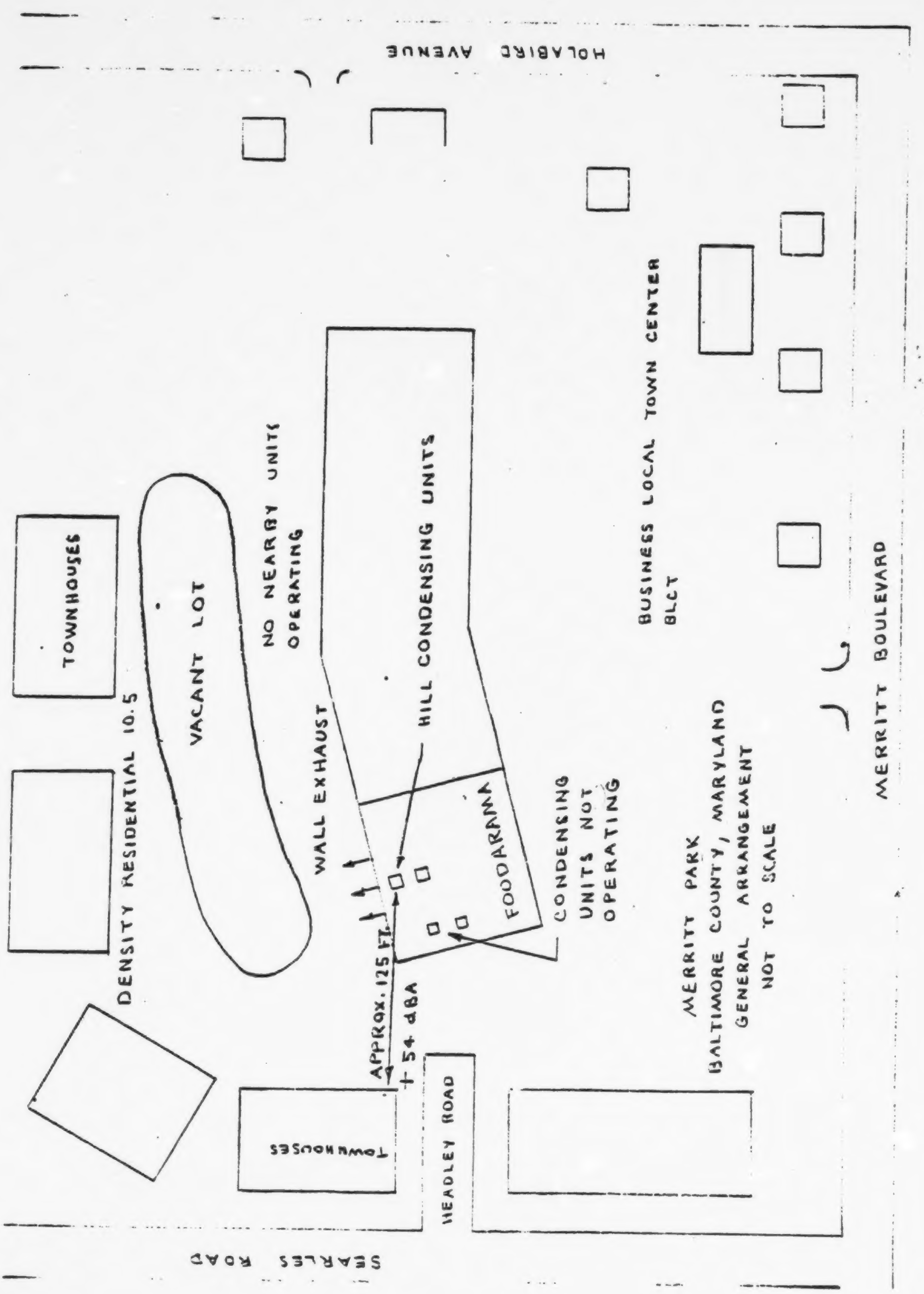
GRAND UNION
FERNDALE MARYLAND
ZONED RESIDENTIAL

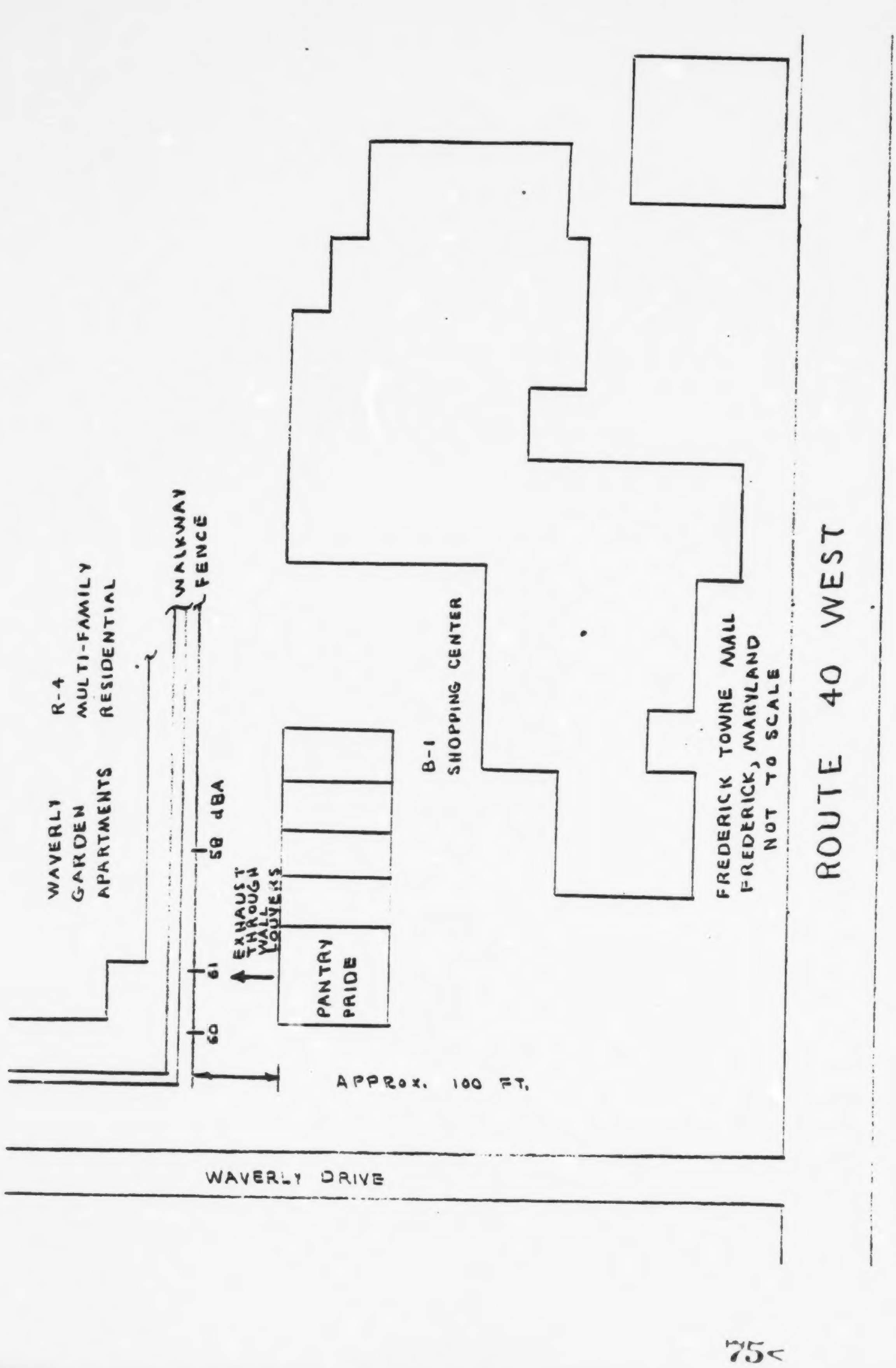

R-5
H
54 dBA
54-55 dBA
54 dBA
HARRIS HEIGHTS DIRVE
DRIVEWAY FOR GIANT
N
100'
100'
125'
RECOLD REFRIG
A-C
A-C
GIANT FOOD STORE
MELCO A/c UNITS
A-C
A-C
N
NOT TO SCALE
PARKING LOT
BACK GROUND FROM RITCHIE HIGHWAY
C-3
PARKING LOT
RITCHIE HIGHWAY

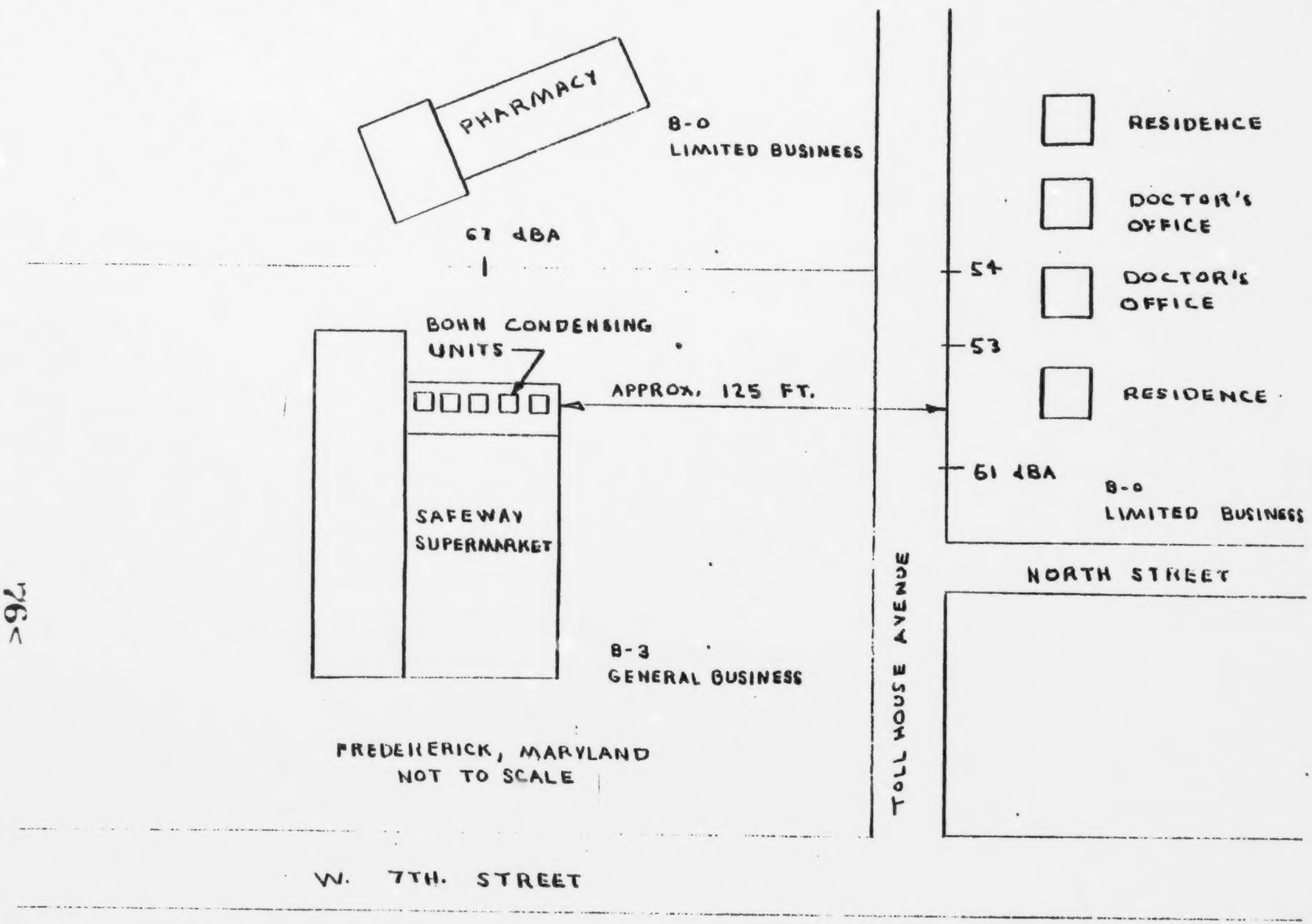
GIANT FOOD STORE
GLEN BURNIE MARYLAND
ZONED RESIDENTIAL

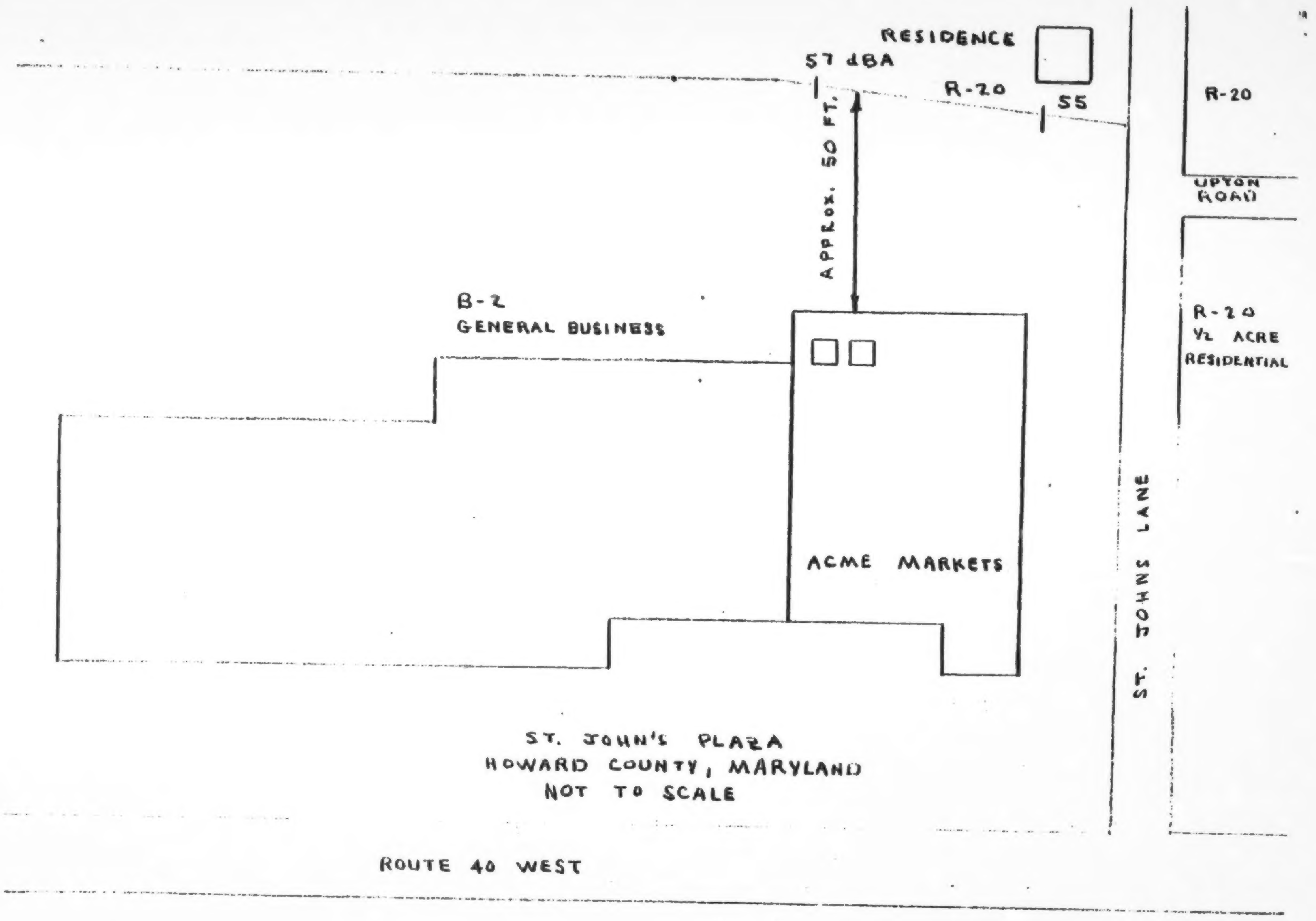

RESIDENCE
B-2
RESIDENTIAL DRIVEWAY
69 dBA
APPROX. 7 FT.
BOHN CONDENSING UNIT FOR REFRIGERATION
× 63 dBA
APPROX. 10 FT.
TRANE CONENSING UNIT FOR AIR CONDITIONING
7 ELEVEN STORE
WILLOUGHBY BEACH ROAD
B-2
COMMUNITY BUSINESS
MARYLAND ROUTE 24

EDGEWOOD
HARFORD COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

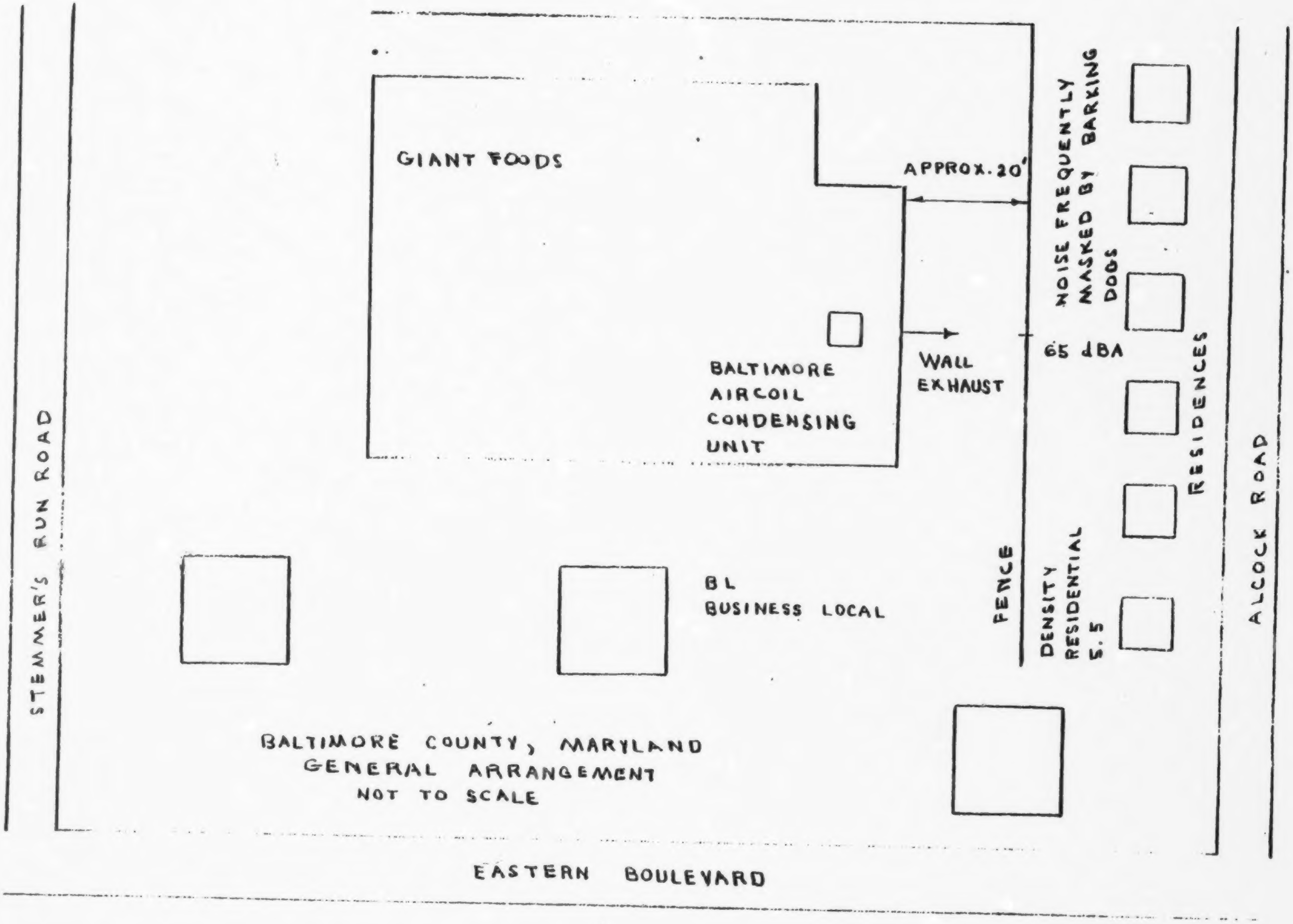

HOLABIRD AVENUE
SEARLES ROAD
HEADLEY ROAD
TOWNHOUSES
TOWNHOUSES
DENSITY RESIDENTIAL 10.5
VACANT LOT
NO NEARBY UNITS OPERATING
WALL EXHAUST
HILL CONDENSING UNITS
FOODARAMA
CONDENSING UNITS NOT OPERATING
APPROX. 125 FT.
+ 54 dBA
BUSINESS LOCAL TOWN CENTER
BLCT
MERRITT BOULEVARD
MERRITT PARK
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE


WAVERLY GARDEN APARTMENTS
R-4 MULTI-FAMILY RESIDENTIAL
WALKWAY
FENCE
60
61
58 dBA
EXHAUST THROUGH WALL LOUVERS
PANTRY PRIDE
APPROX. 100 FT.
B-1 SHOPPING CENTER
FREDERICK TOWNE MALL
FREDERICK, MARYLAND
NOT TO SCALE
ROUTE 40 WEST
WAVERLY DRIVE

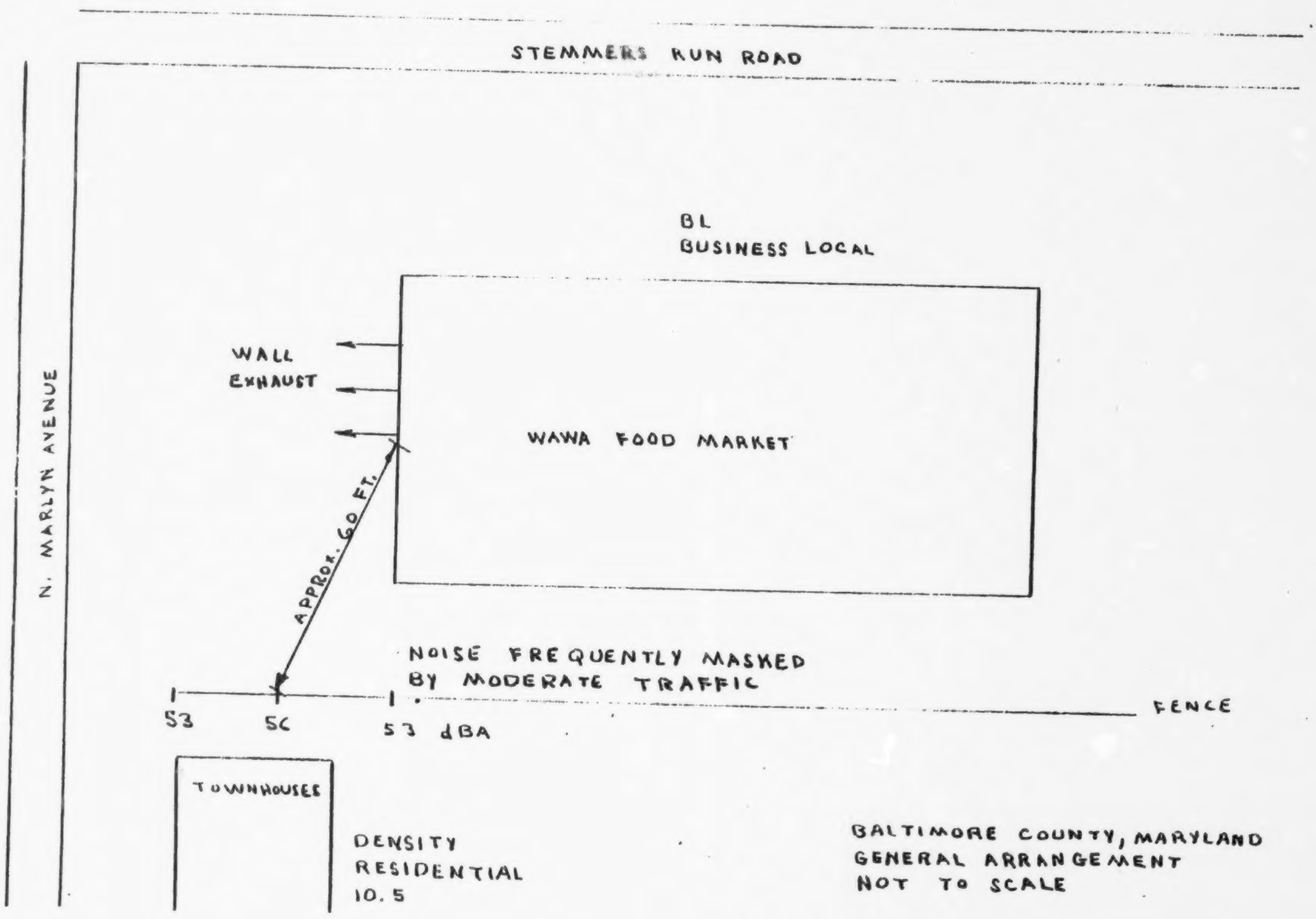

PHARMACY
B-0
LIMITED BUSINESS
67 dBA
BOHN CONDENSING
UNITS
APPROX. 125 FT.
SAFEWAY
SUPERMARKET
B-3
GENERAL BUSINESS
FREDEHERICK, MARYLAND
NOT TO SCALE
W. 7TH. STREET
TOLL HOUSE AVENUE
54
53
61 dBA
RESIDENCE
DOCTOR'S
OFFICE
DOCTOR'S
OFFICE
RESIDENCE
B-0
LIMITED BUSINESS
NORTH STREET


RESIDENCE
57 dBA
R-20
55
R-20
UPTON ROAD
APPROX. 50 FT.
B-2
GENERAL BUSINESS
R-20
½ ACRE
RESIDENTIAL
ACME MARKETS
ST. JOHNS LANE
ROUTE 40 WEST

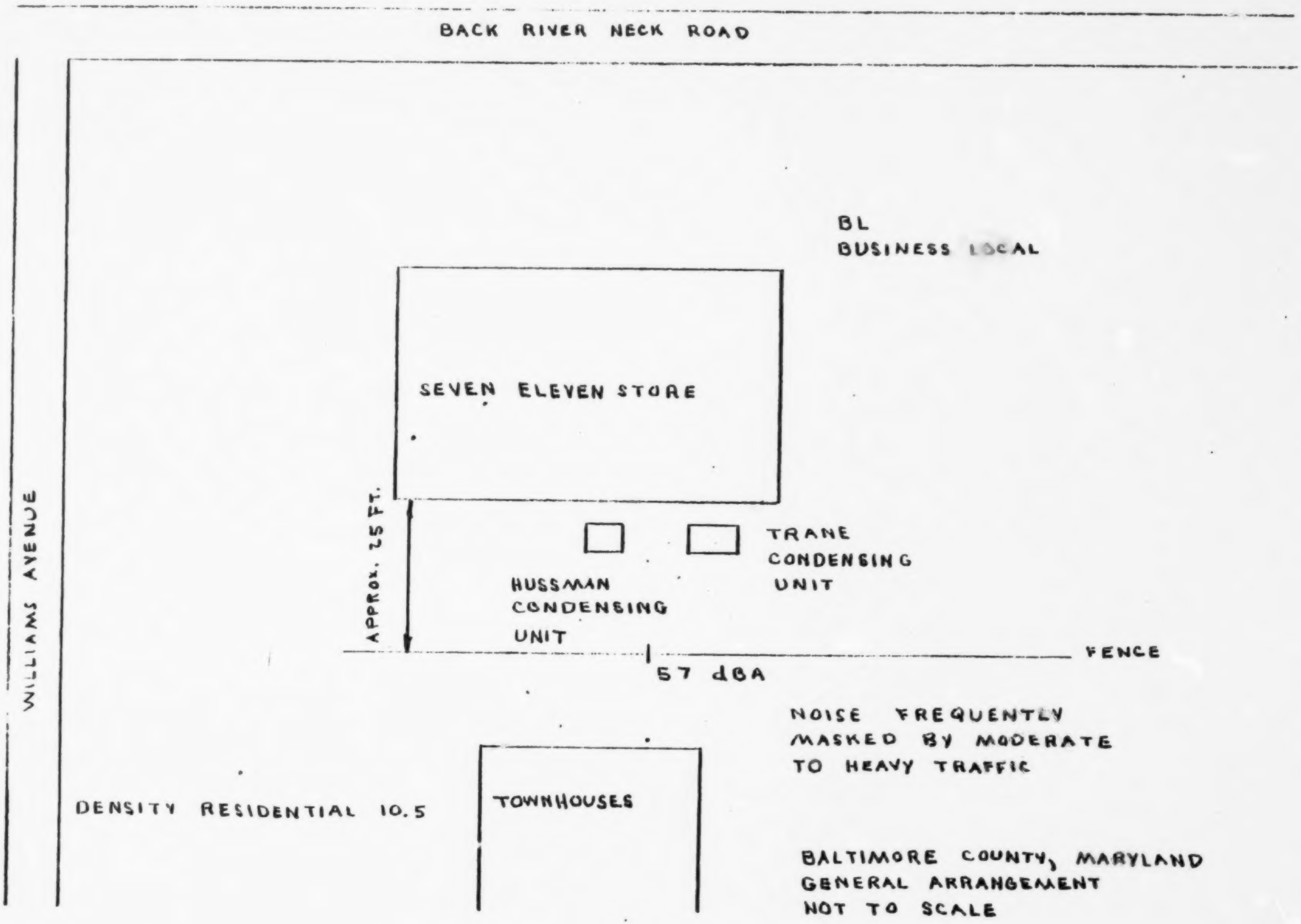
ST. JOHN'S PLAZA
HOWARD COUNTY, MARYLAND
NOT TO SCALE

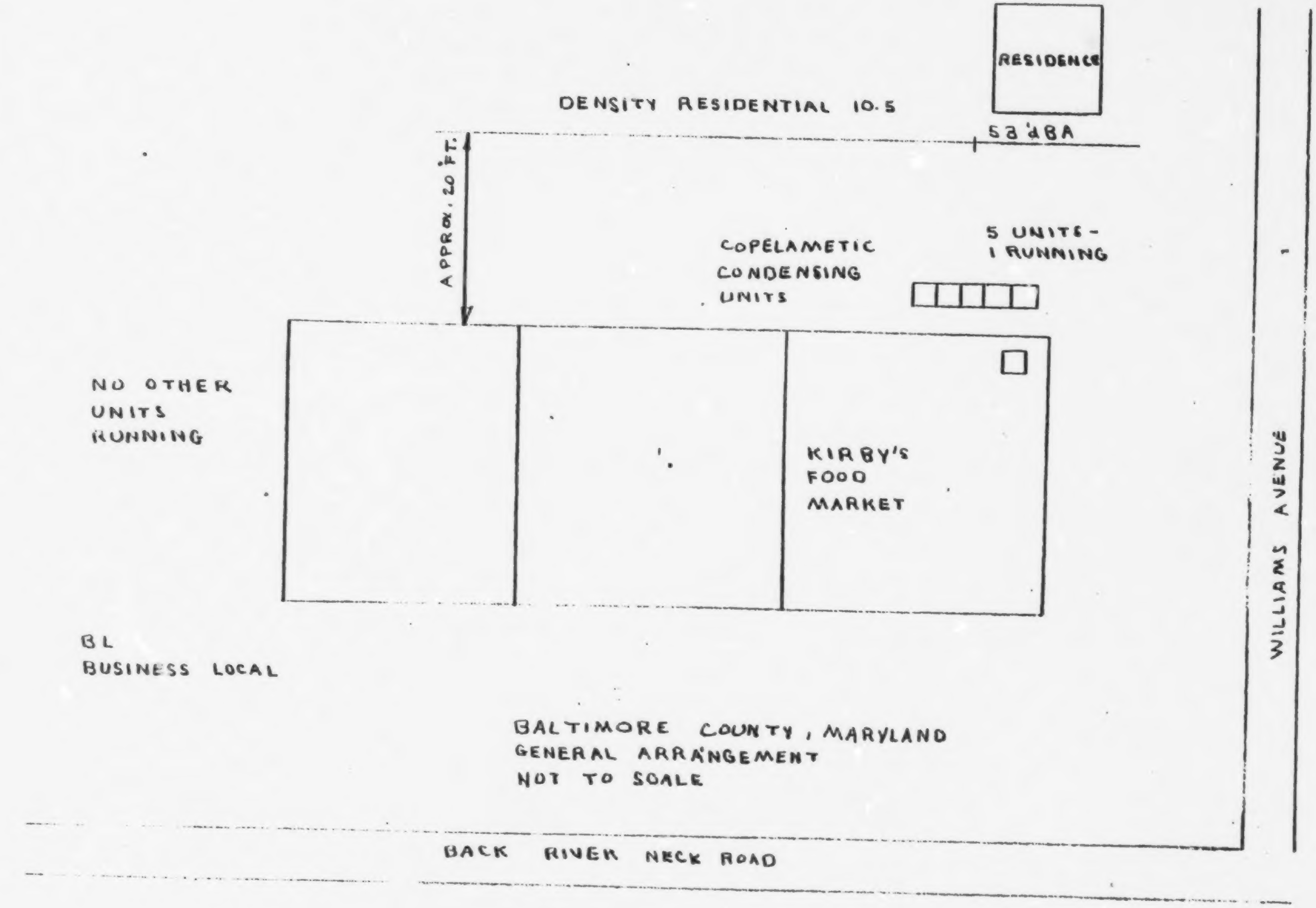

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

STEMMER'S RUN ROAD
ALCOCK ROAD
EASTERN BOULEVARD
GIANT FOODS
BALTIMORE AIRCOIL CONDENSING UNIT
APPROX. 20'
WALL EXHAUST
65 dBA
NOISE FREQUENTLY MASKED BY BARKING DOGS
RESIDENCES
FENCE
DENSITY RESIDENTIAL 5.5
BL BUSINESS LOCAL

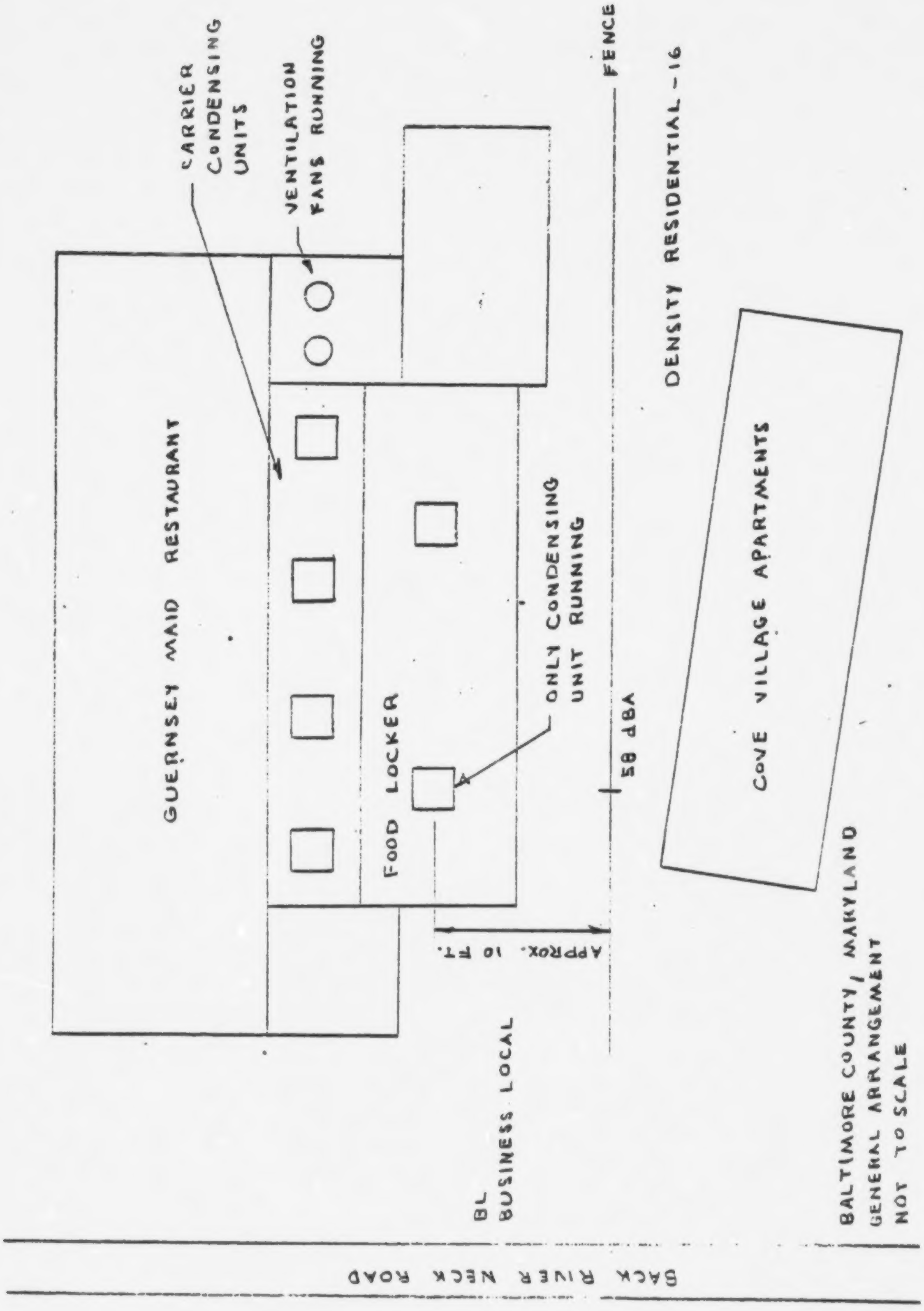

STEMMERS RUN ROAD
N. MARLYN AVENUE
BL
BUSINESS LOCAL
WALL
EXHAUST
WAWA FOOD MARKET
APPROX. 60 FT.
NOISE FREQUENTLY MASKED
BY MODERATE TRAFFIC
53
5C
53 dBA
FENCE
TOWNHOUSES
DENSITY
RESIDENTIAL
10.5

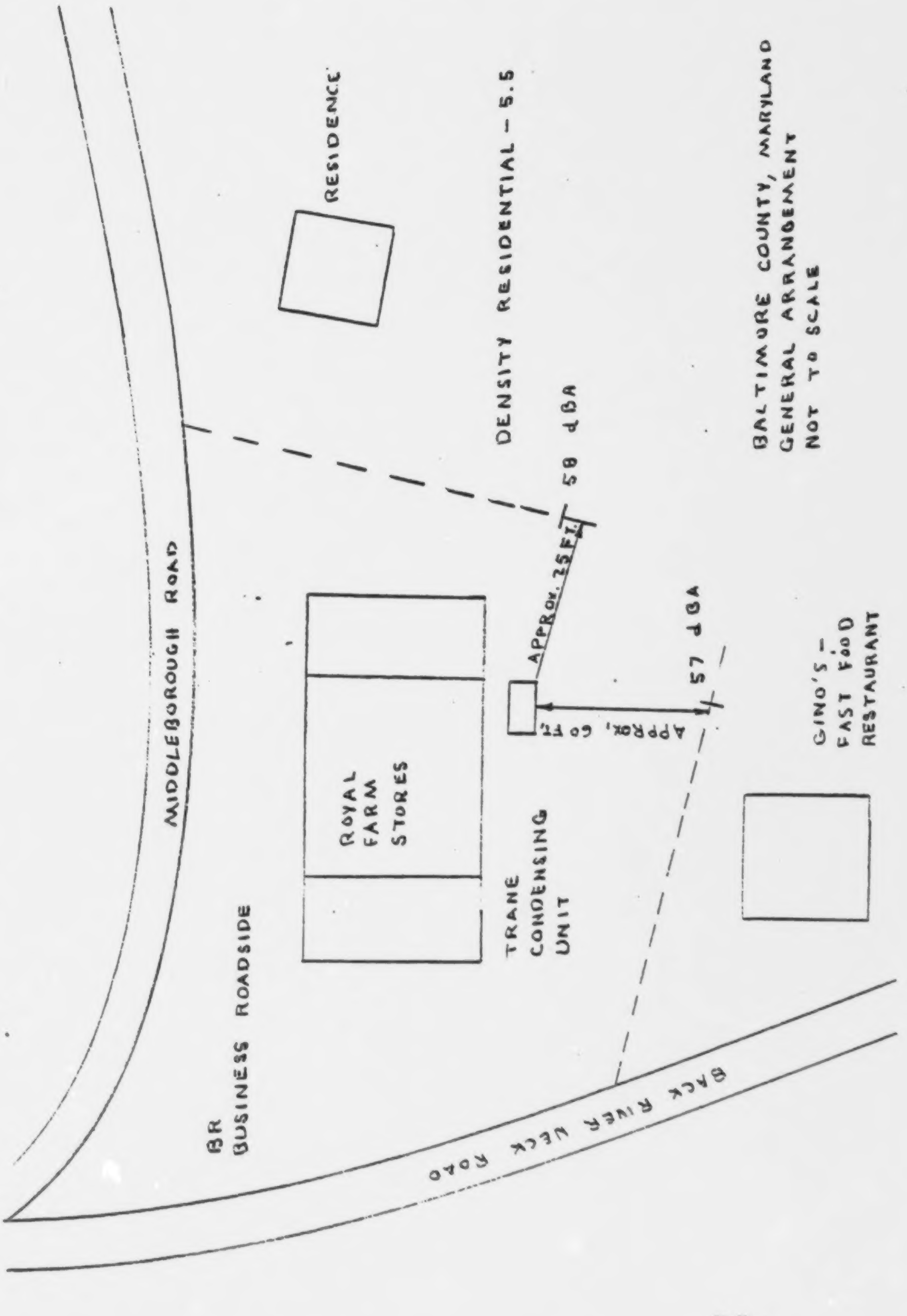
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE


BACK RIVER NECK ROAD
WILLIAMS AVENUE
BL
BUSINESS LOCAL
SEVEN ELEVEN STORE
TRANE
CONDENSING
UNIT
HUSSMAN
CONDENSING
UNIT
APPROX. 25 FT.
FENCE
57 dBA
NOISE FREQUENTLY
MASKED BY MODERATE
TO HEAVY TRAFFIC
DENSITY RESIDENTIAL 10.5
TOWNHOUSES
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

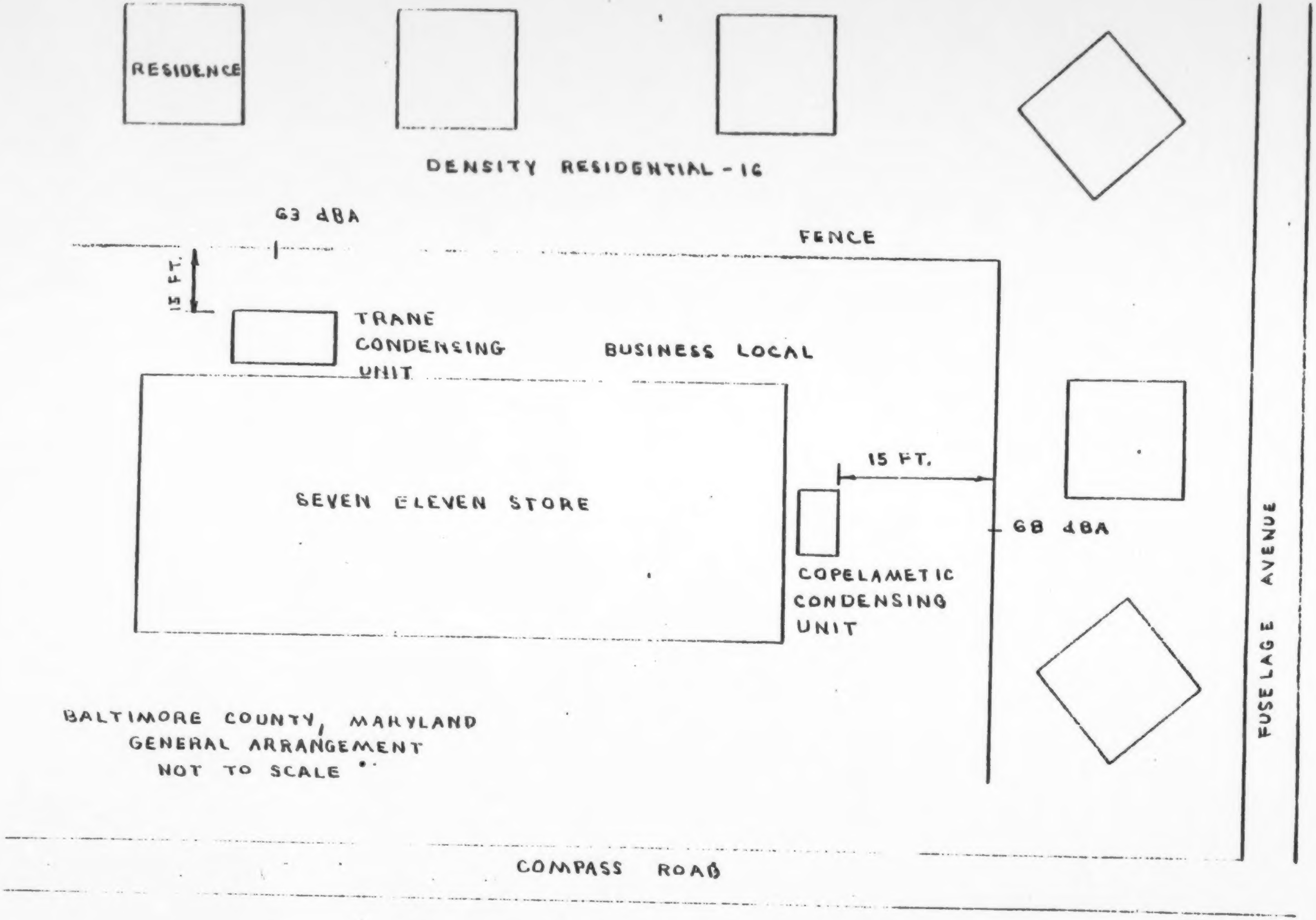

RESIDENCE
DENSITY RESIDENTIAL 10.5
53 dBA
APPROX. 20 FT.
COPELAMETIC
CONDENSING
UNITS
5 UNITS -
1 RUNNING
NO OTHER
UNITS
RUNNING
KIRBY'S
FOOD
MARKET
WILLIAMS AVENUE
BL
BUSINESS LOCAL
BACK RIVER NECK ROAD

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

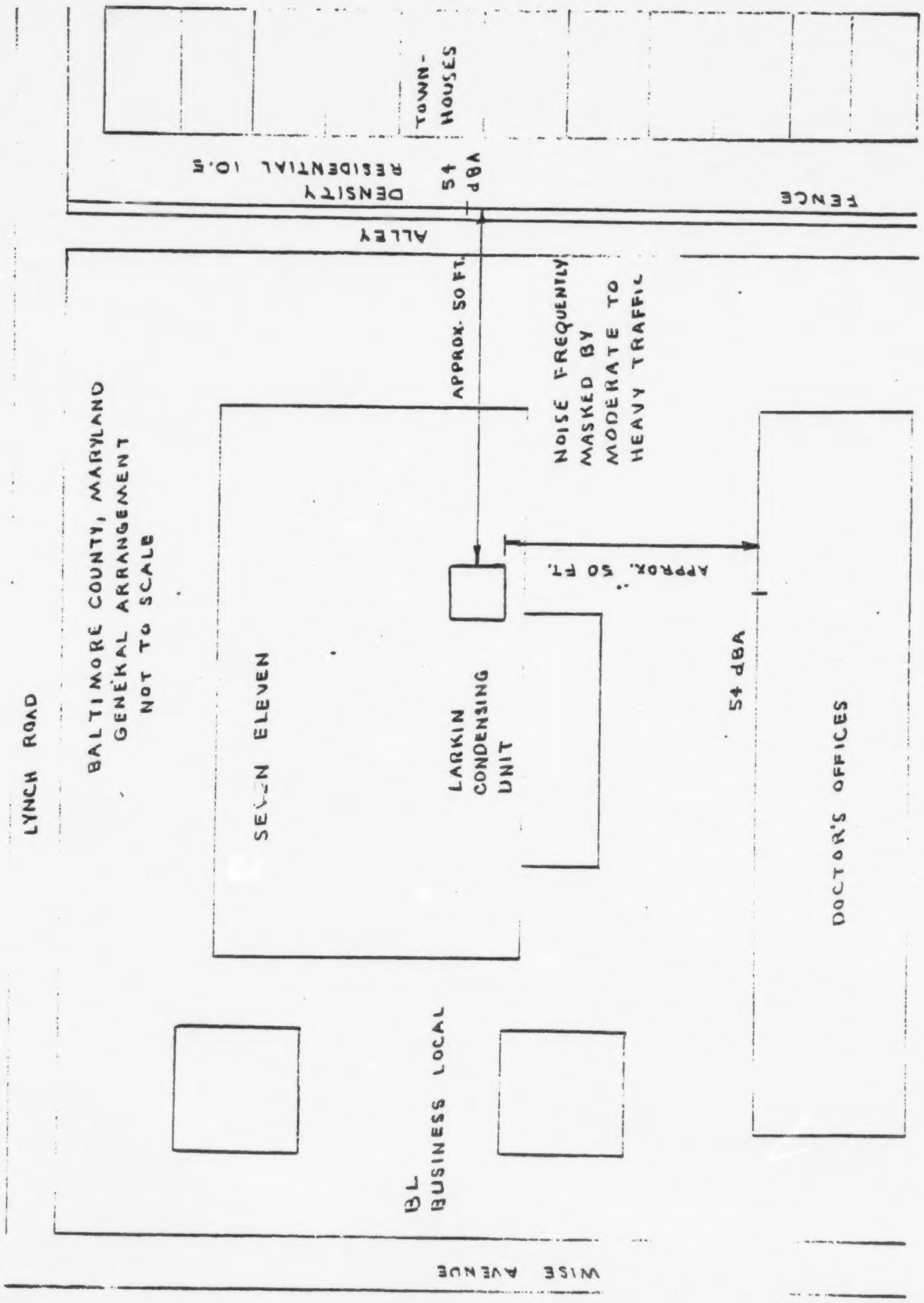

CARRIER CONDENSING UNITS
VENTILATION FANS RUNNING
FENCE
DENSITY RESIDENTIAL - 16
GUERNSEY MAID RESTAURANT
FOOD LOCKER
ONLY CONDENSING UNIT RUNNING
A
58 dBA
APPROX. 10 FT.
COVE VILLAGE APARTMENTS
BL
BUSINESS LOCAL
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
BACK RIVER NECK ROAD

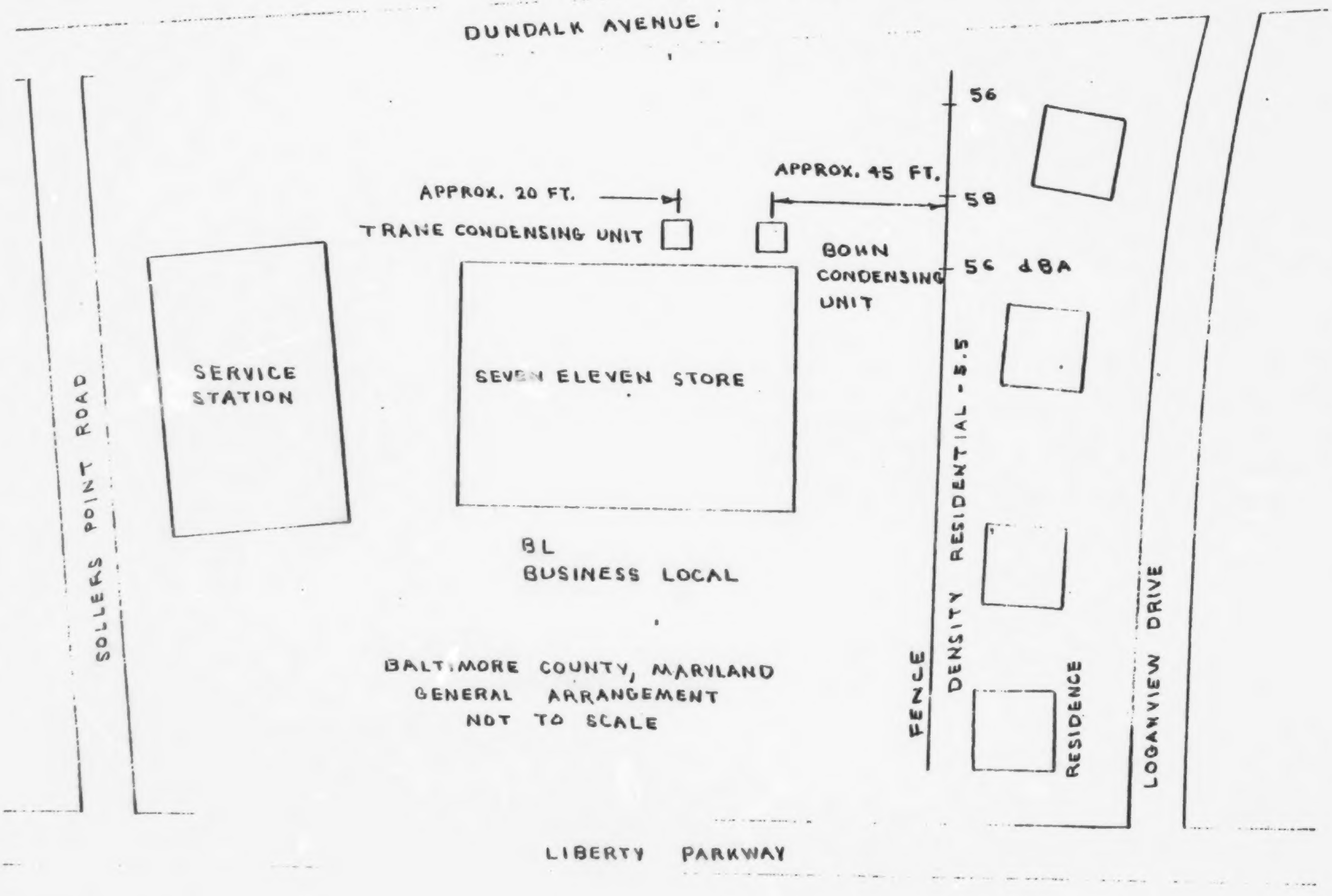

MIDDLEBOROUGH ROAD
RESIDENCE
DENSITY RESIDENTIAL – 5.5
58 dBA
APPROX. 25 FT.
ROYAL FARM STORES
APPROX. 60 FT.
57 dBA
GINO'S – FAST FOOD RESTAURANT
TRANE CONDENSING UNIT
BR BUSINESS ROADSIDE
BACK RIVER NECK ROAD

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

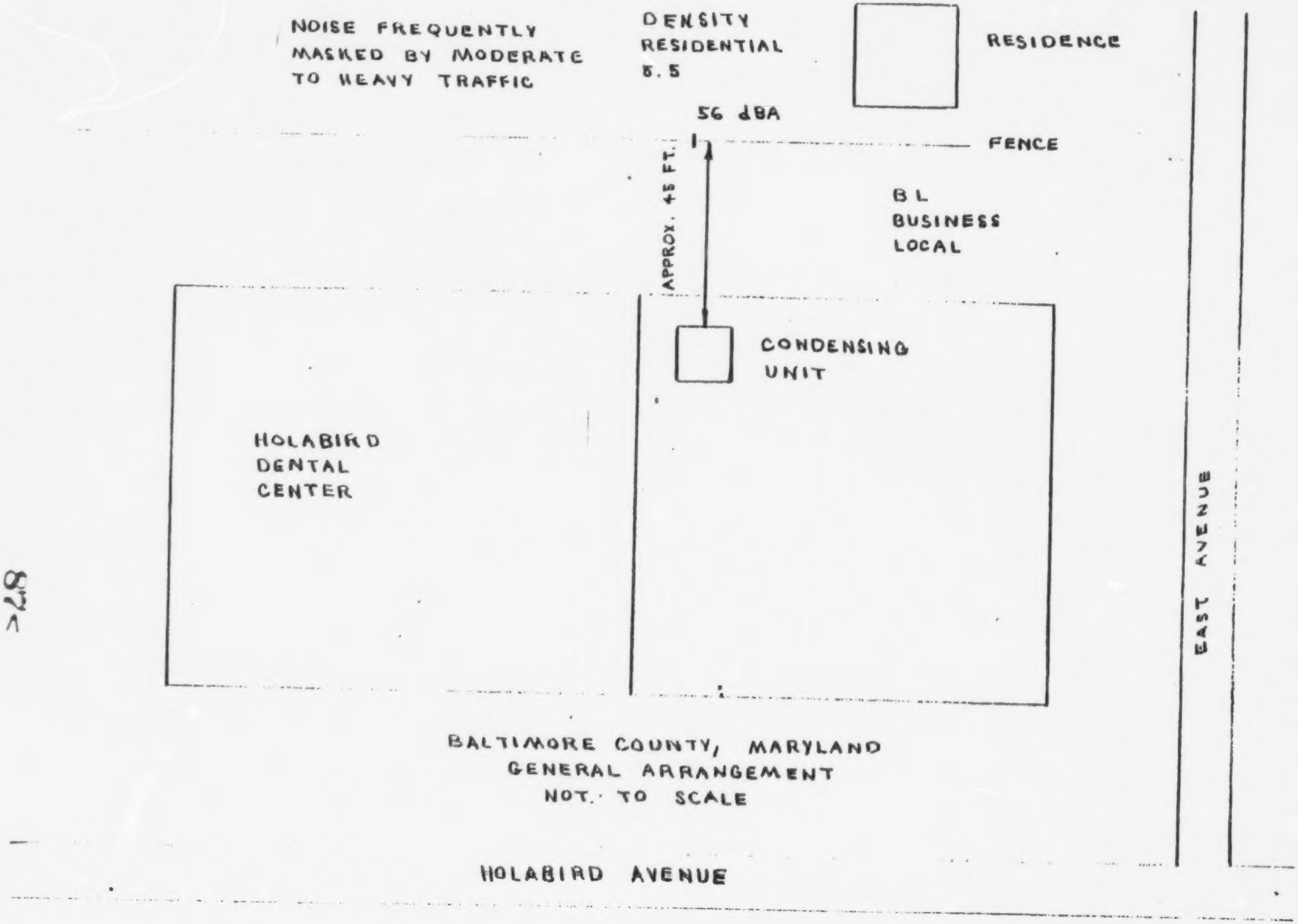

RESIDENCE
DENSITY RESIDENTIAL - 16
63 dBA
15 FT.
FENCE
TRANE CONDENSING UNIT
BUSINESS LOCAL
SEVEN ELEVEN STORE
15 FT.
68 dBA
COPELAMETIC CONDENSING UNIT
FUSELAGE AVENUE
COMPASS ROAD

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

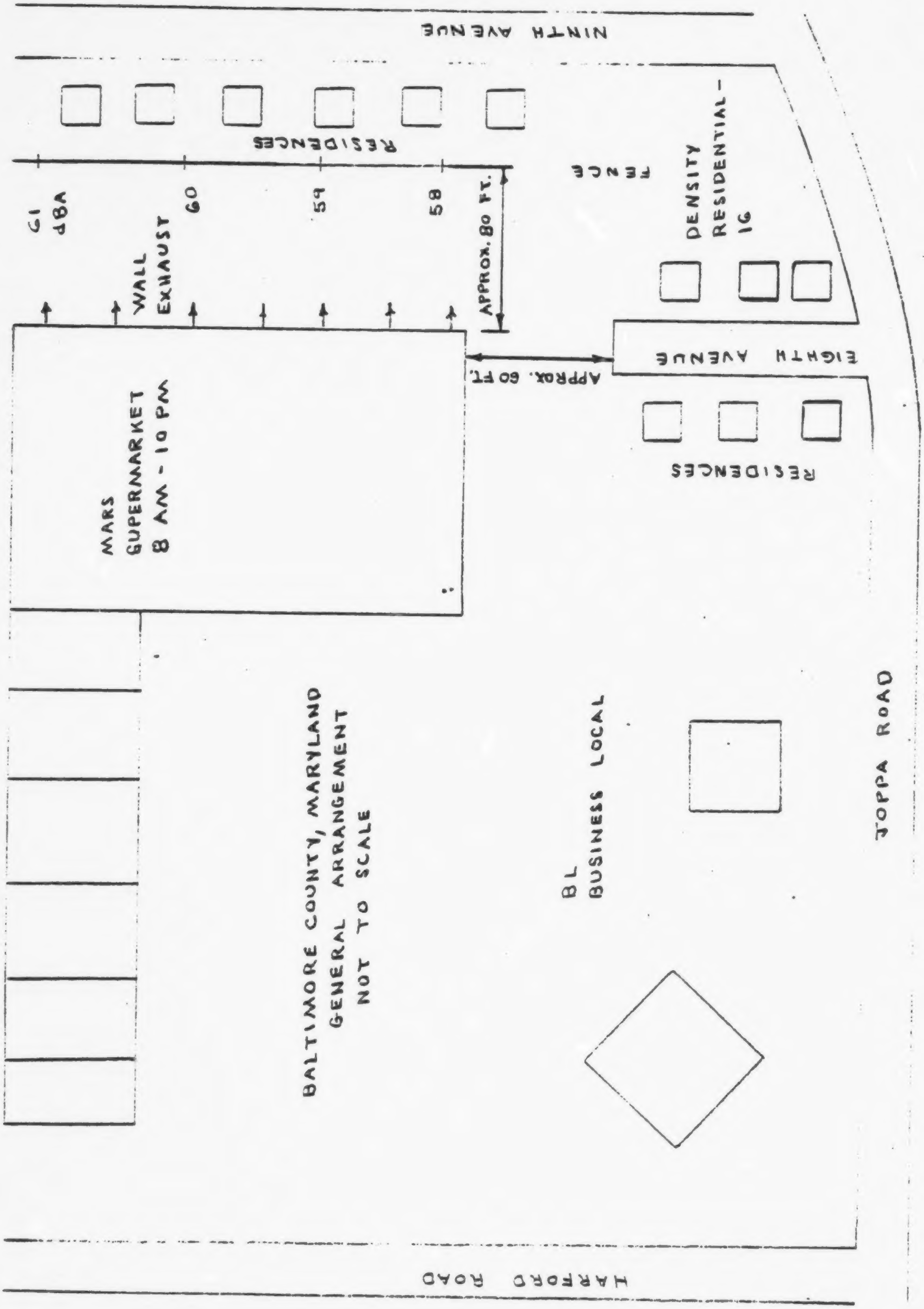

LYNCH ROAD
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
SEVEN ELEVEN
LARKIN
CONDENSING
UNIT
DOCTOR'S OFFICES
54 dBA
APPROX. 50 FT.
NOISE FREQUENTLY
MASKED BY
MODERATE TO
HEAVY TRAFFIC
APPROX. 50 FT.
54 dBA
ALLEY
FENCE
DENSITY
RESIDENTIAL 10.5
TOWN-
HOUSES
BL
BUSINESS LOCAL
WISE AVENUE

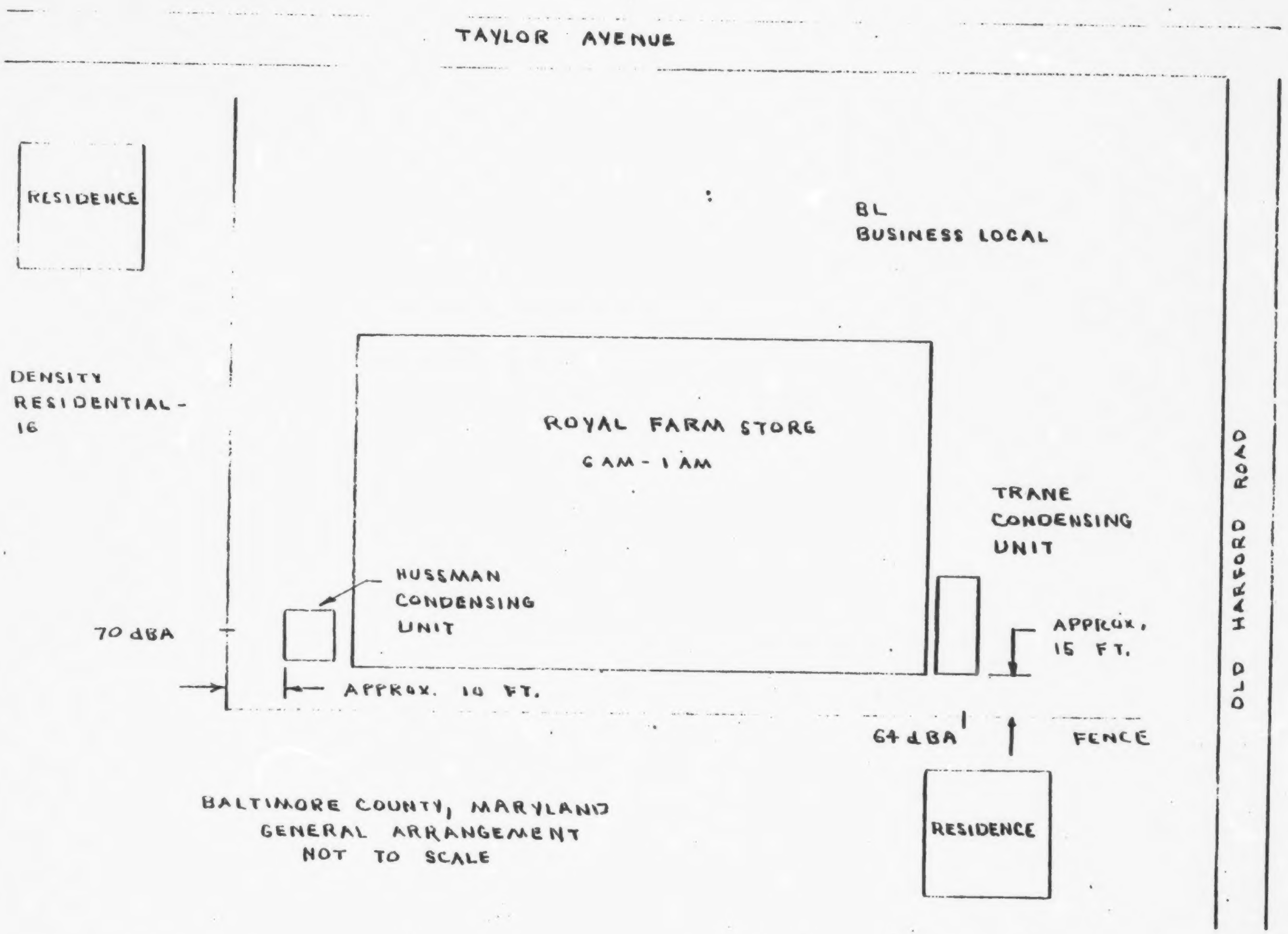

DUNDALK AVENUE
SOLLERS POINT ROAD
SERVICE STATION
APPROX. 20 FT.
TRANE CONDENSING UNIT
APPROX. 45 FT.
BOHN CONDENSING UNIT
SEVEN ELEVEN STORE
BL
BUSINESS LOCAL
56
58
56 dBA
FENCE
DENSITY RESIDENTIAL - 5.5
RESIDENCE
LOGANVIEW DRIVE
LIBERTY PARKWAY

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

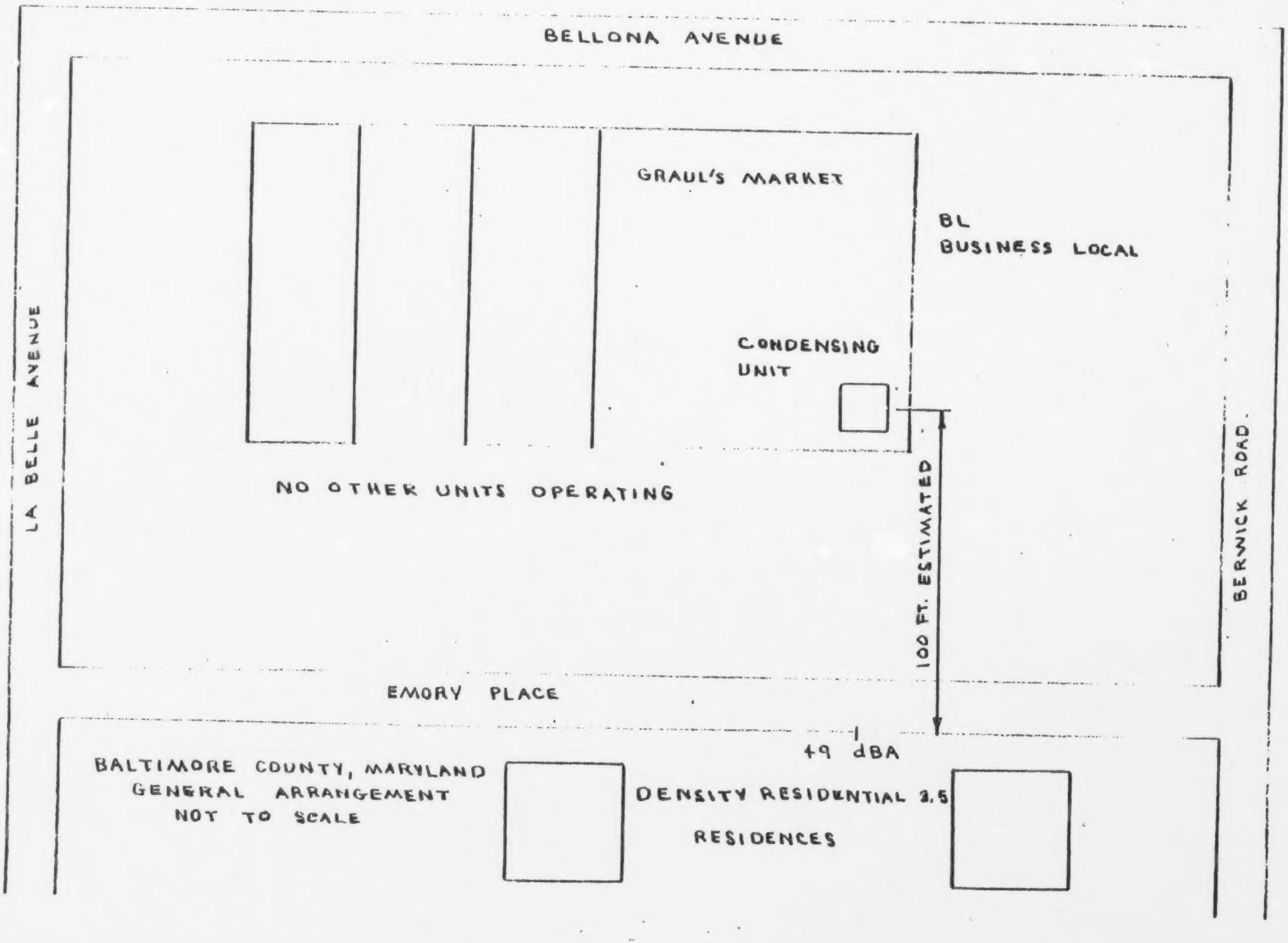

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

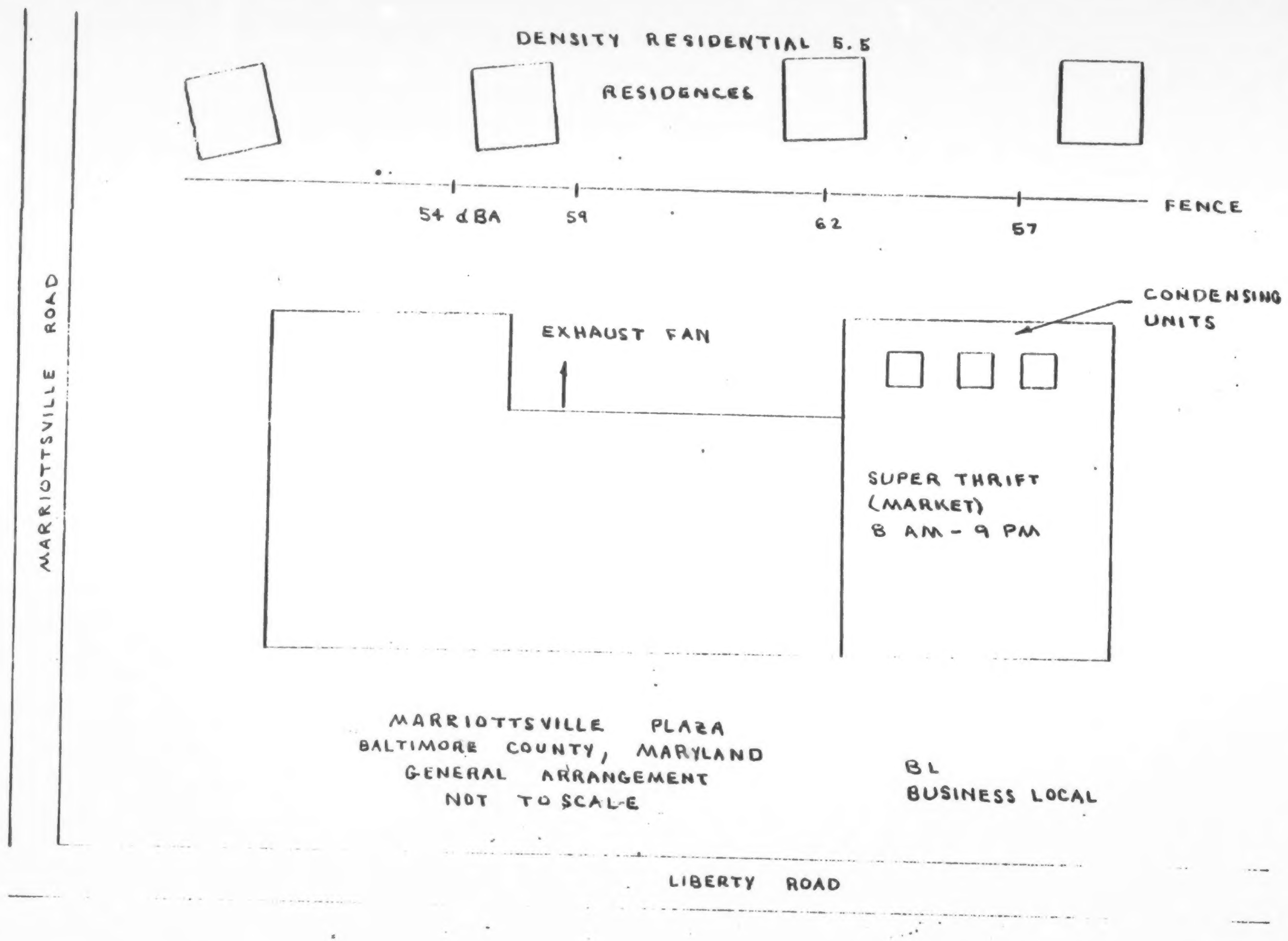
NOISE FREQUENTLY MASKED BY MODERATE TO HEAVY TRAFFIC
DENSITY RESIDENTIAL 5.5
RESIDENCE
56 dBA
FENCE
APPROX. 45 FT.
BL BUSINESS LOCAL
CONDENSING UNIT
HOLABIRD DENTAL CENTER
EAST AVENUE
HOLABIRD AVENUE


NINTH AVENUE
RESIDENCES
FENCE
DENSITY RESIDENTIAL - 16
61 dBA
60
59
58
WALL EXHAUST
APPROX. 80 FT.
APPROX. 60 FT.
EIGHTH AVENUE
RESIDENCES
MARS SUPERMARKET 8 AM - 10 PM
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
BL
BUSINESS LOCAL
JOPPA ROAD
HARFORD ROAD

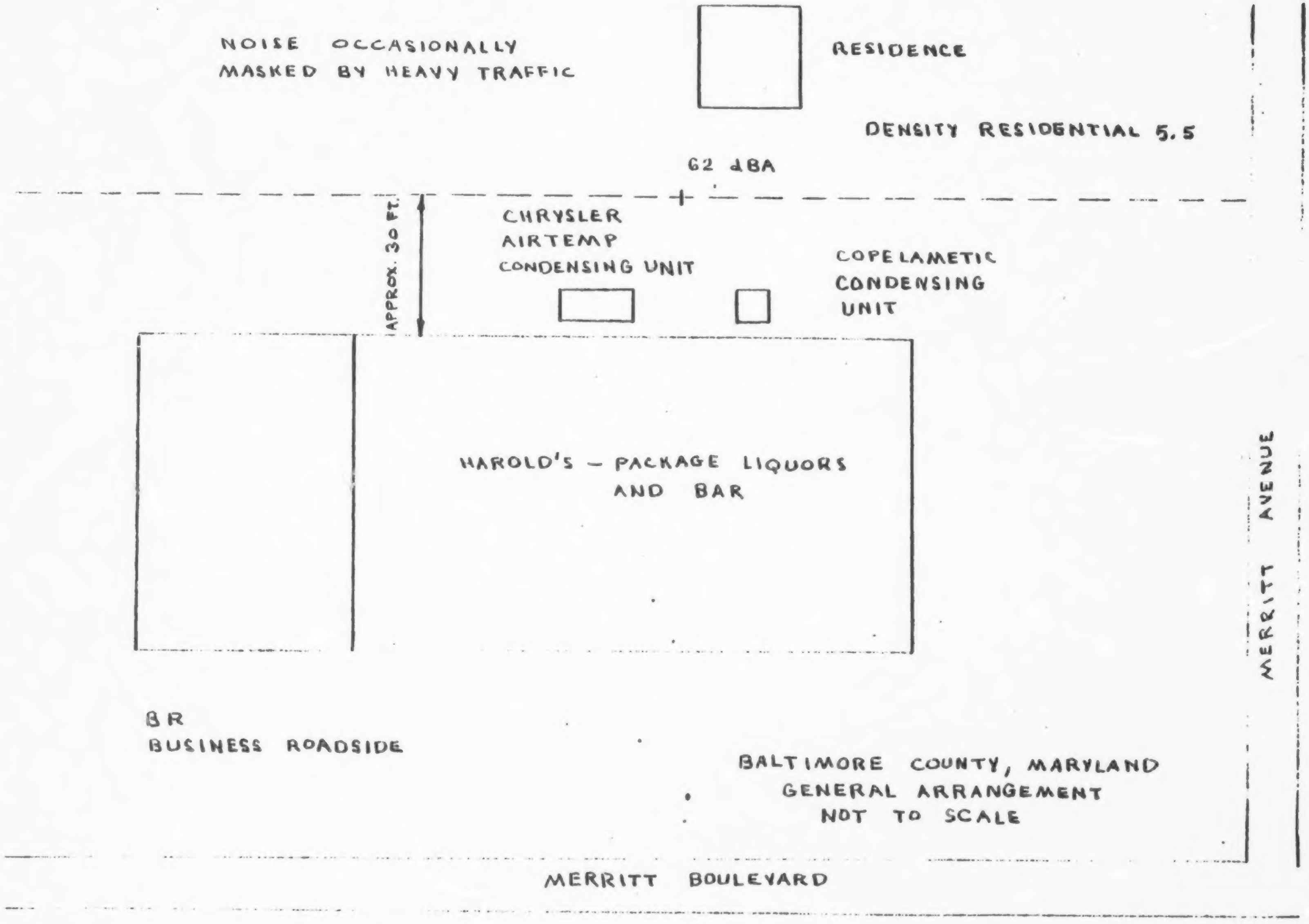

TAYLOR AVENUE
RESIDENCE
BL
BUSINESS LOCAL
DENSITY
RESIDENTIAL -
16
ROYAL FARM STORE
6 AM - 1 AM
TRANE
CONDENSING
UNIT
HUSSMAN
CONDENSING
UNIT
70 dBA
APPROX. 10 FT.
APPROX.
15 FT.
64 dBA
FENCE
RESIDENCE
OLD HARFORD ROAD

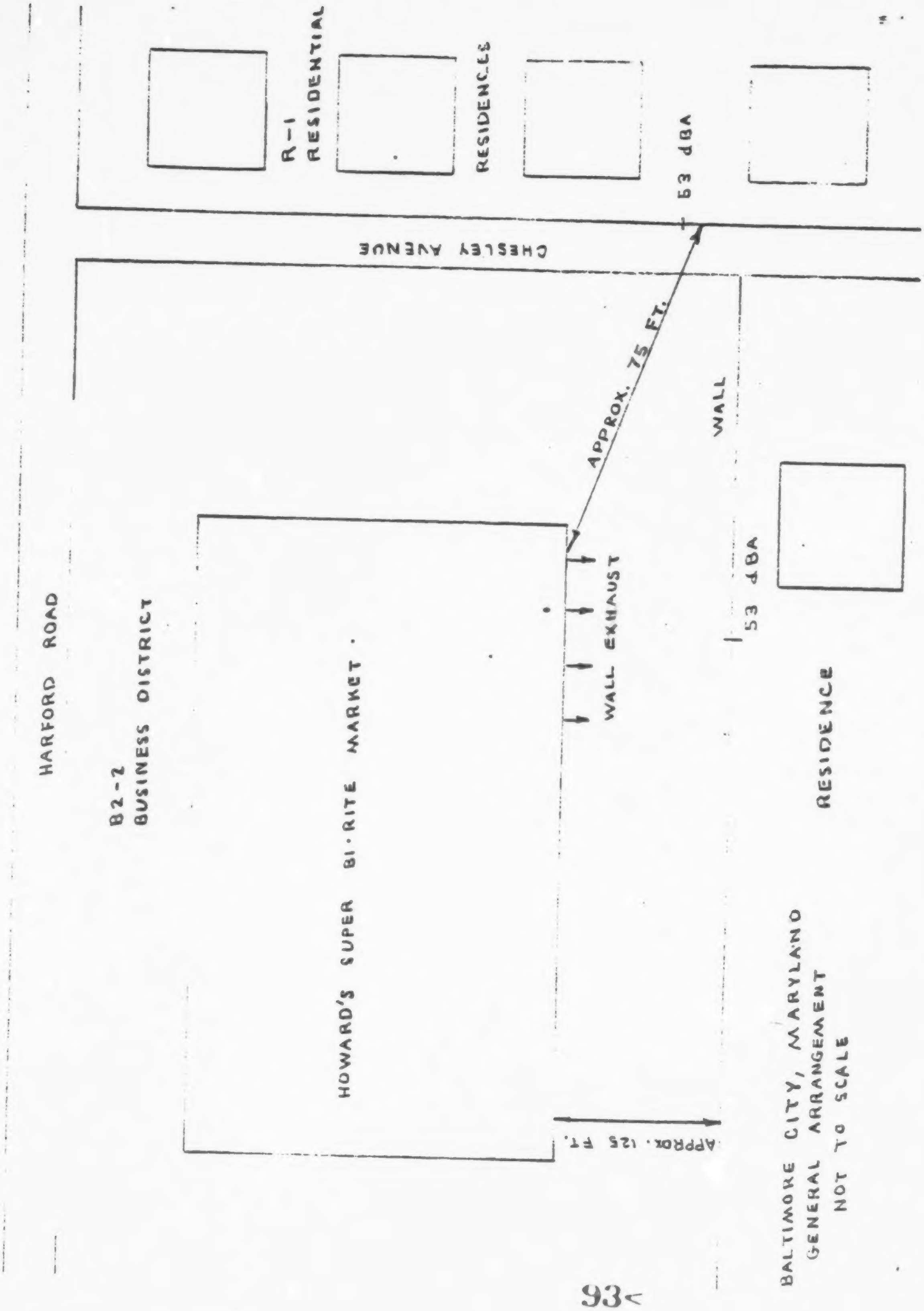
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE


BELLONA AVENUE
GRAUL'S MARKET
BL
BUSINESS LOCAL
CONDENSING
UNIT
LA BELLE AVENUE
NO OTHER UNITS OPERATING
100 FT. ESTIMATED
BERWICK ROAD.
EMORY PLACE
49 dBA
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
DENSITY RESIDENTIAL 3.5
RESIDENCES

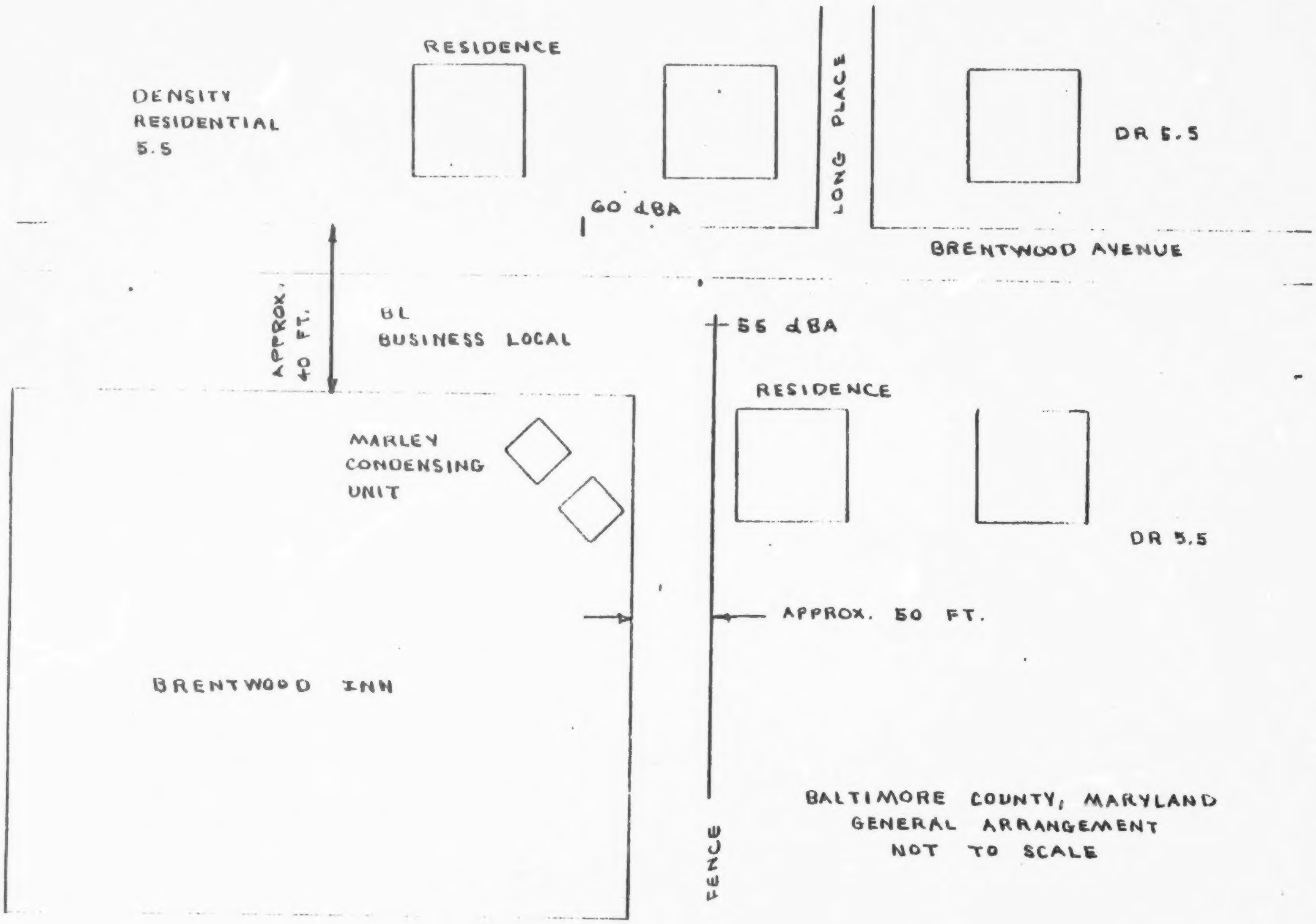

DENSITY RESIDENTIAL 5.5
RESIDENCES
54 dBA
59
62
57
FENCE
CONDENSING UNITS
EXHAUST FAN
SUPER THRIFT
(MARKET)
8 AM - 9 PM
BL
BUSINESS LOCAL
MARRIOTTSVILLE ROAD
LIBERTY ROAD

MARRIOTTSVILLE PLAZA
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

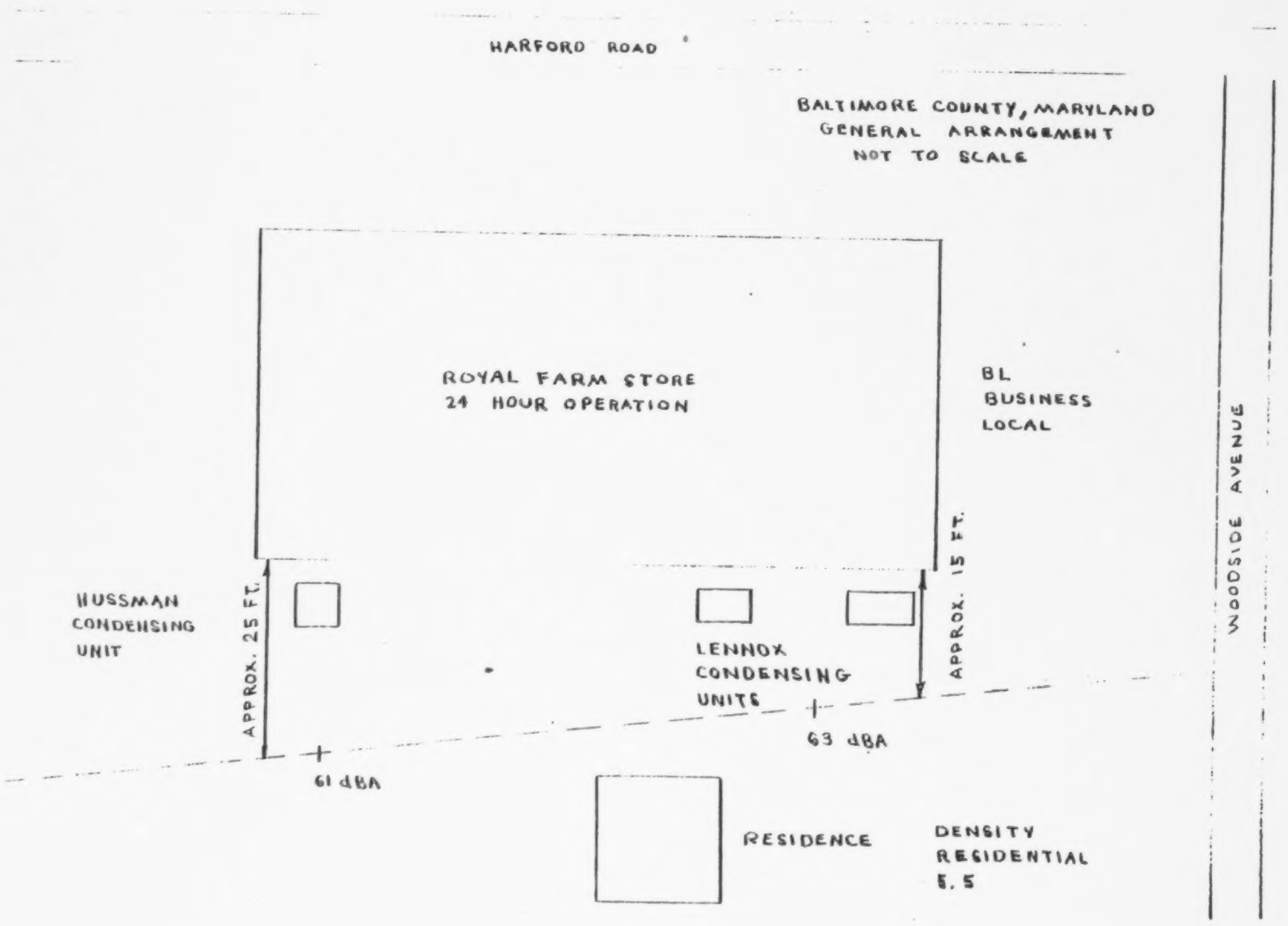

NOISE OCCASIONALLY
MASKED BY HEAVY TRAFFIC
RESIDENCE
DENSITY RESIDENTIAL 5.5
62 dBA
APPROX. 30 FT.
CHRYSLER
AIRTEMP
CONDENSING UNIT
COPELAMETIC
CONDENSING
UNIT
HAROLD'S – PACKAGE LIQUORS
AND BAR
MERRITT AVENUE
BR
BUSINESS ROADSIDE
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
MERRITT BOULEVARD

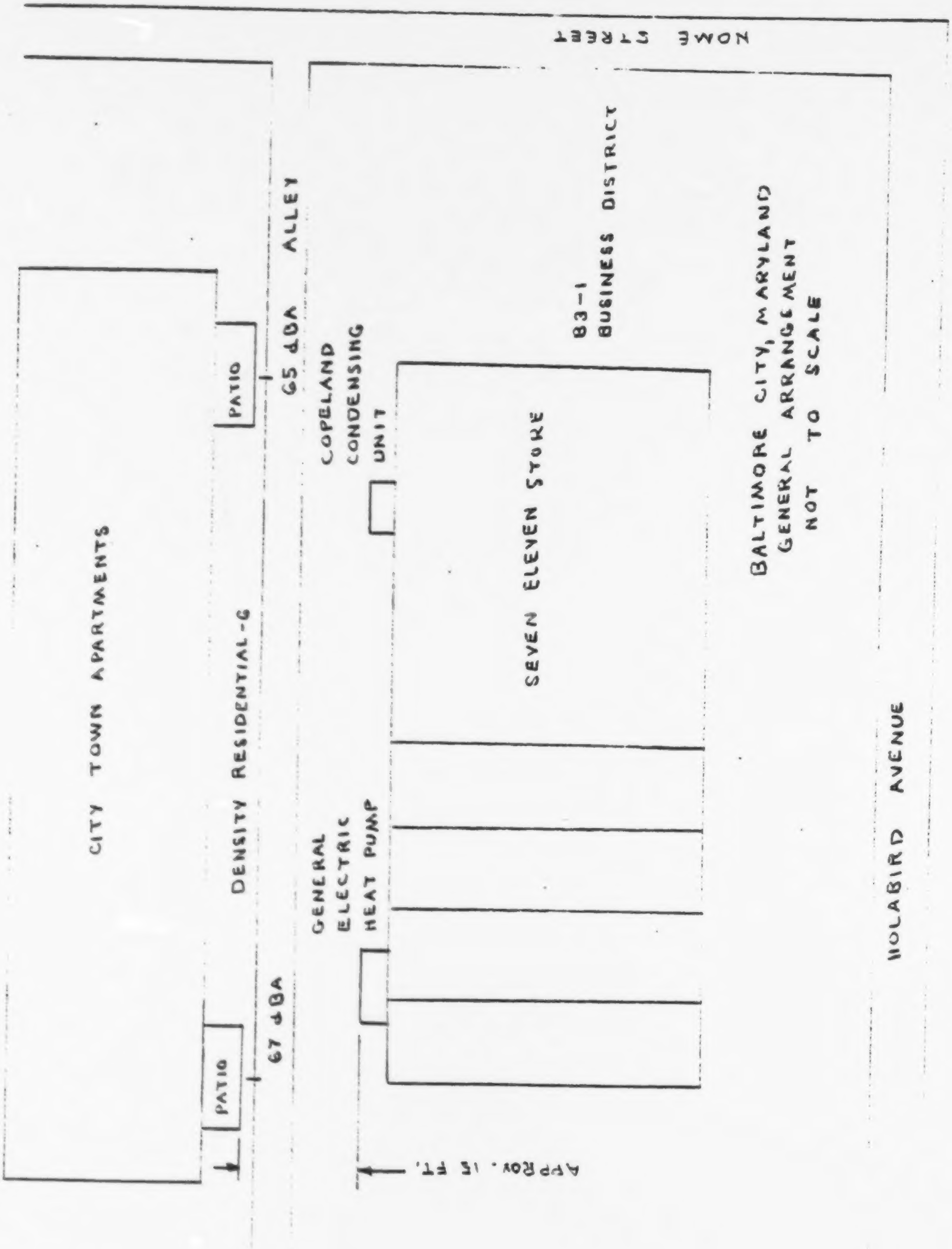

HARFORD ROAD
B2-2
BUSINESS DISTRICT
HOWARD'S SUPER BI-RITE MARKET
WALL EXHAUST
APPROX. 75 FT.
APPROX. 125 FT.
CHESLEY AVENUE
R-1
RESIDENTIAL
RESIDENCES
53 dBA
WALL
53 dBA
RESIDENCE

BALTIMORE CITY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE


RESIDENCE
DENSITY
RESIDENTIAL
5.5
LONG PLACE
DR 5.5
60 dBA
BRENTWOOD AVENUE
APPROX. 40 FT.
BL
BUSINESS LOCAL
55 dBA
RESIDENCE
MARLEY
CONDENSING
UNIT
DR 5.5
APPROX. 50 FT.
BRENTWOOD INN
FENCE

BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE

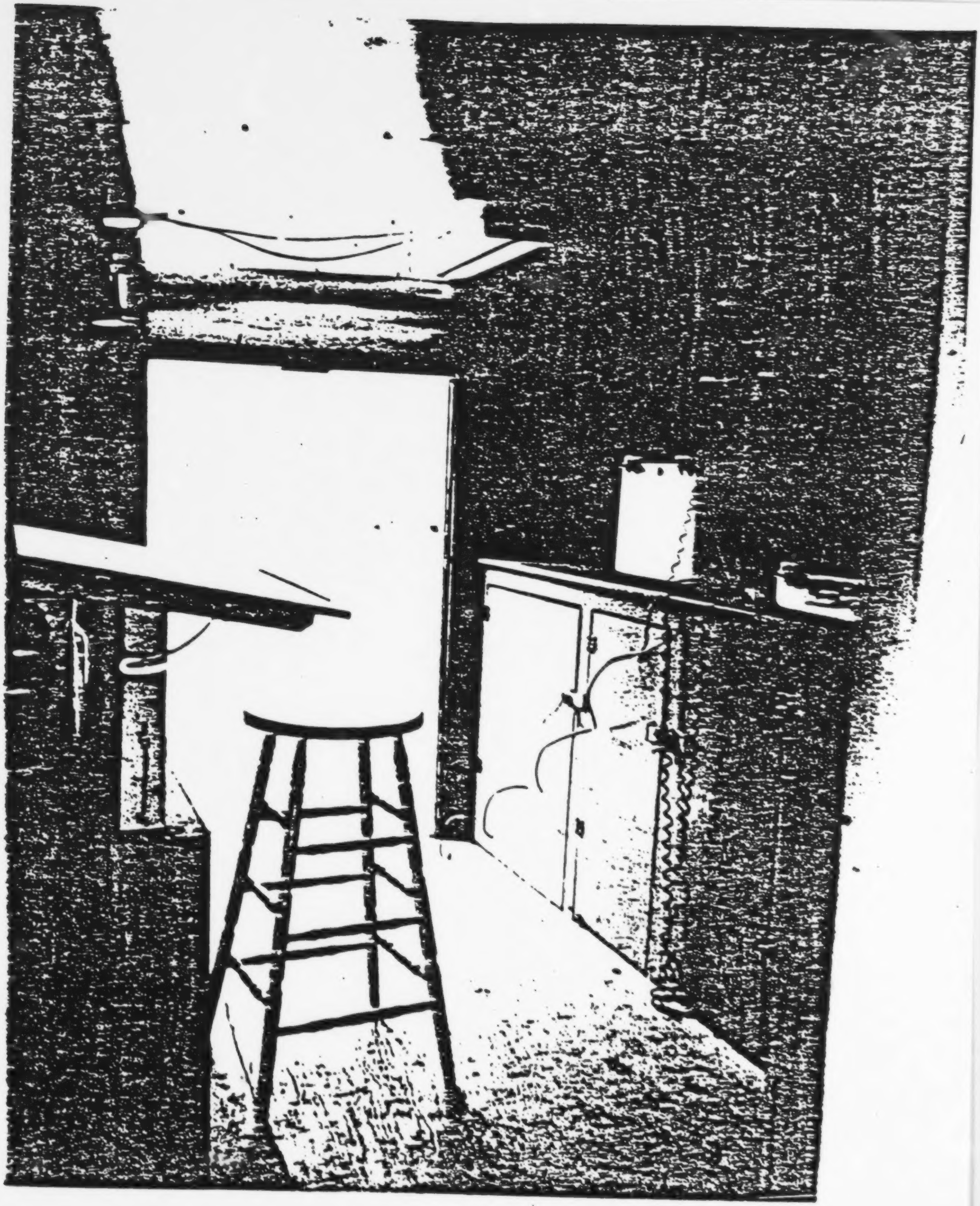

HARFORD ROAD
BALTIMORE COUNTY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
WOODSIDE AVENUE
ROYAL FARM STORE
24 HOUR OPERATION
BL
BUSINESS
LOCAL
APPROX. 15 FT.
APPROX. 25 FT.
HUSSMAN
CONDENSING
UNIT
LENNOX
CONDENSING
UNITS
63 dBA
61 dBA
RESIDENCE
DENSITY
RESIDENTIAL
5.5


NOME STREET
CITY TOWN APARTMENTS
DENSITY RESIDENTIAL-G
PATIO
PATIO
65 dBA
67 dBA
ALLEY
COPELAND CONDENSING UNIT
GENERAL ELECTRIC HEAT PUMP
APPROX. 15 FT.
SEVEN ELEVEN STORE
B3-1 BUSINESS DISTRICT
BALTIMORE CITY, MARYLAND
GENERAL ARRANGEMENT
NOT TO SCALE
HOLABIRD AVENUE

Appendix 3

Photographs of Typical Survey Situations:

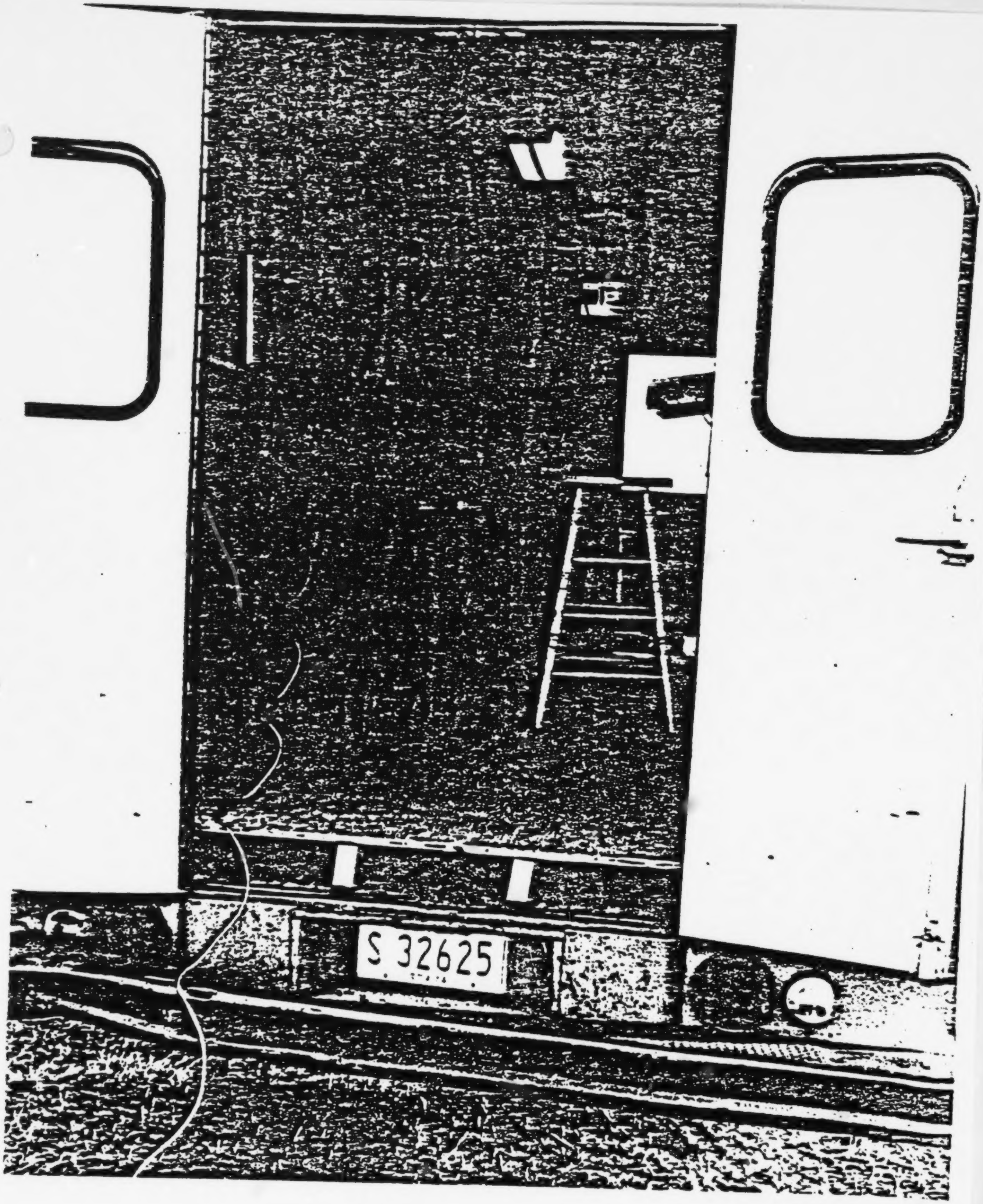
Noise Survey Van
("Old Blue")



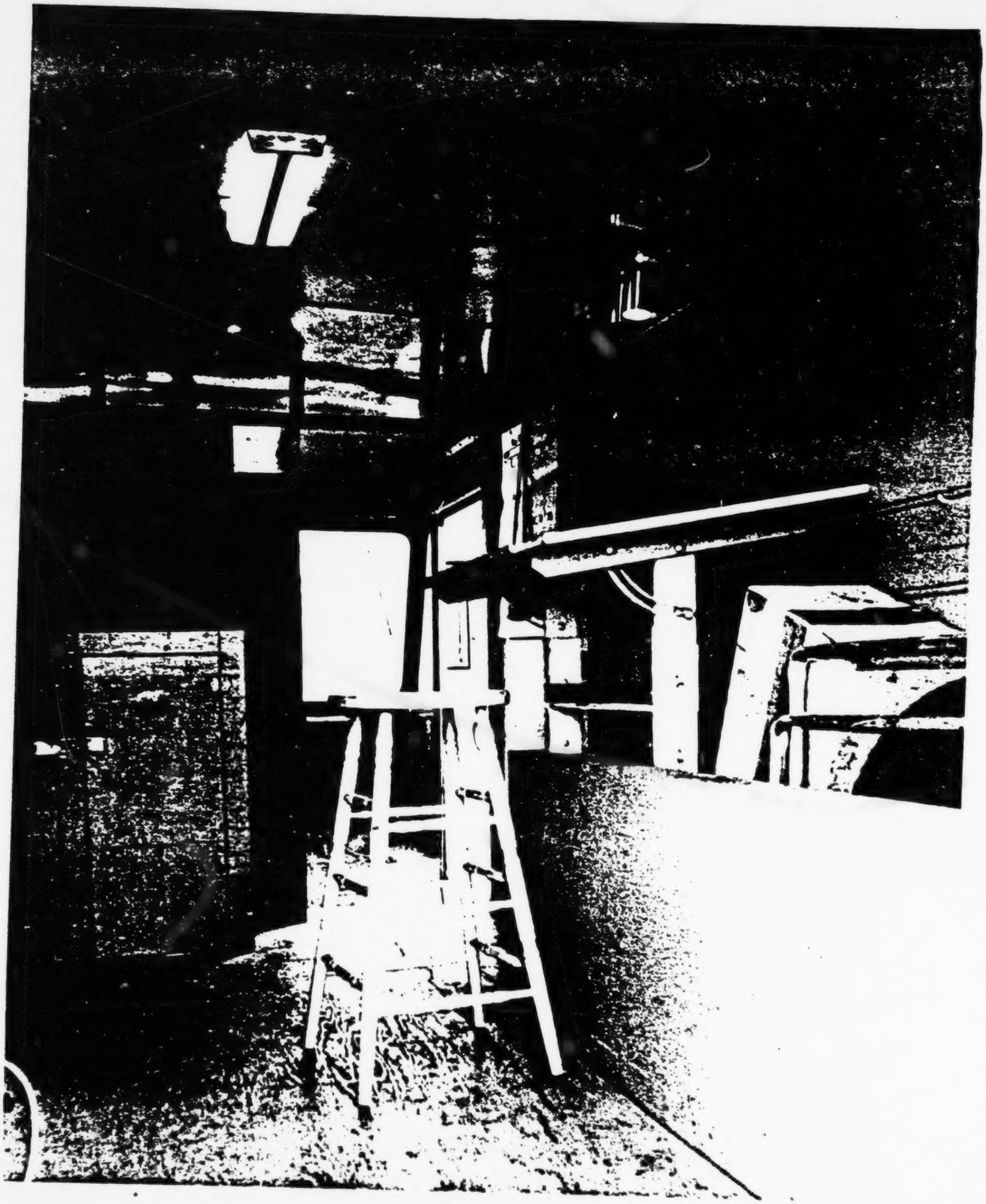
Interior of Noise Survey Van ("Old Blue")

METROSONICS

Noise Survey Equipment



Interior of Noise Survey Van ("Old Blue")

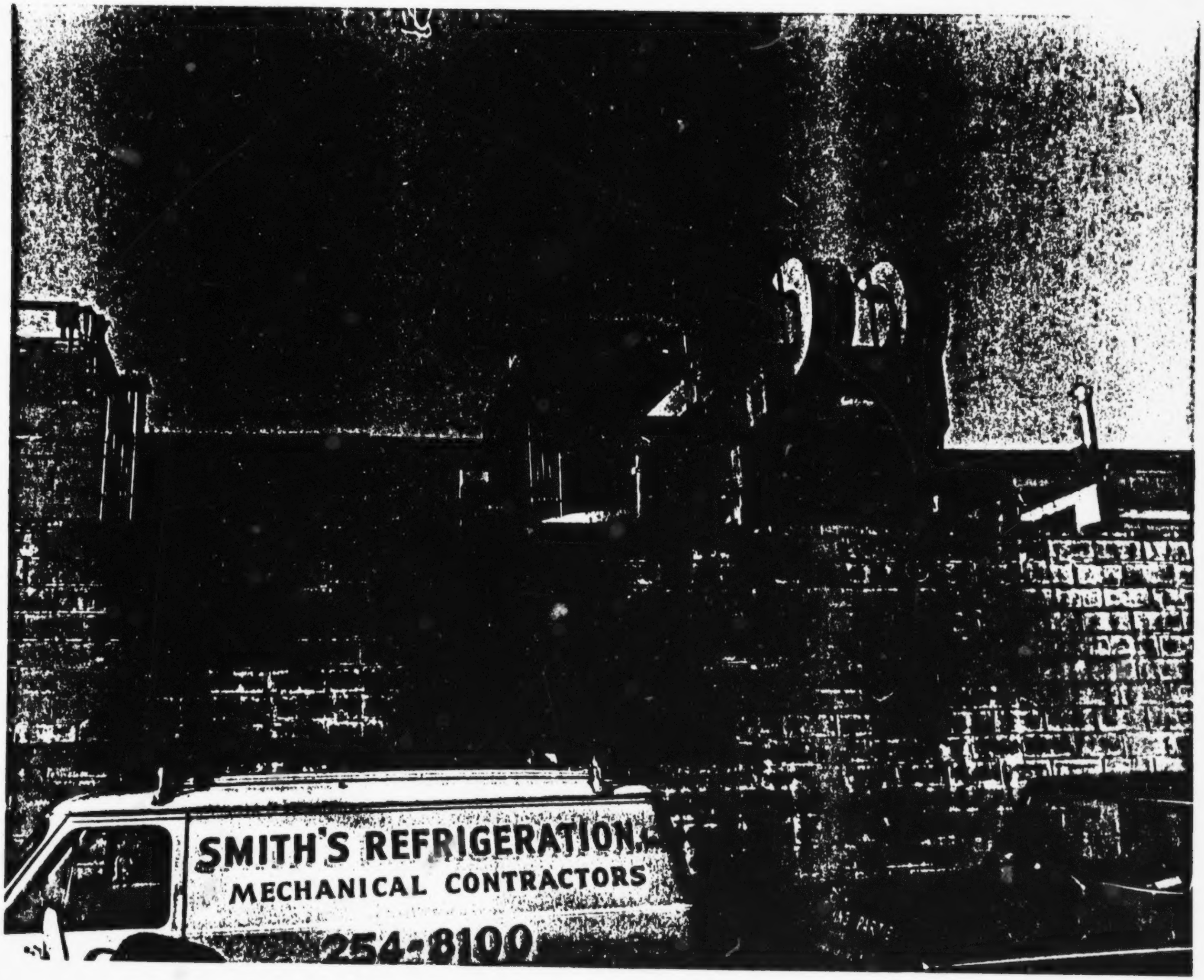


Interior of Noise Survey
Van ("Old Blue")

OLD COURT SAVINGS & LOAN INC.
GRAND UNION

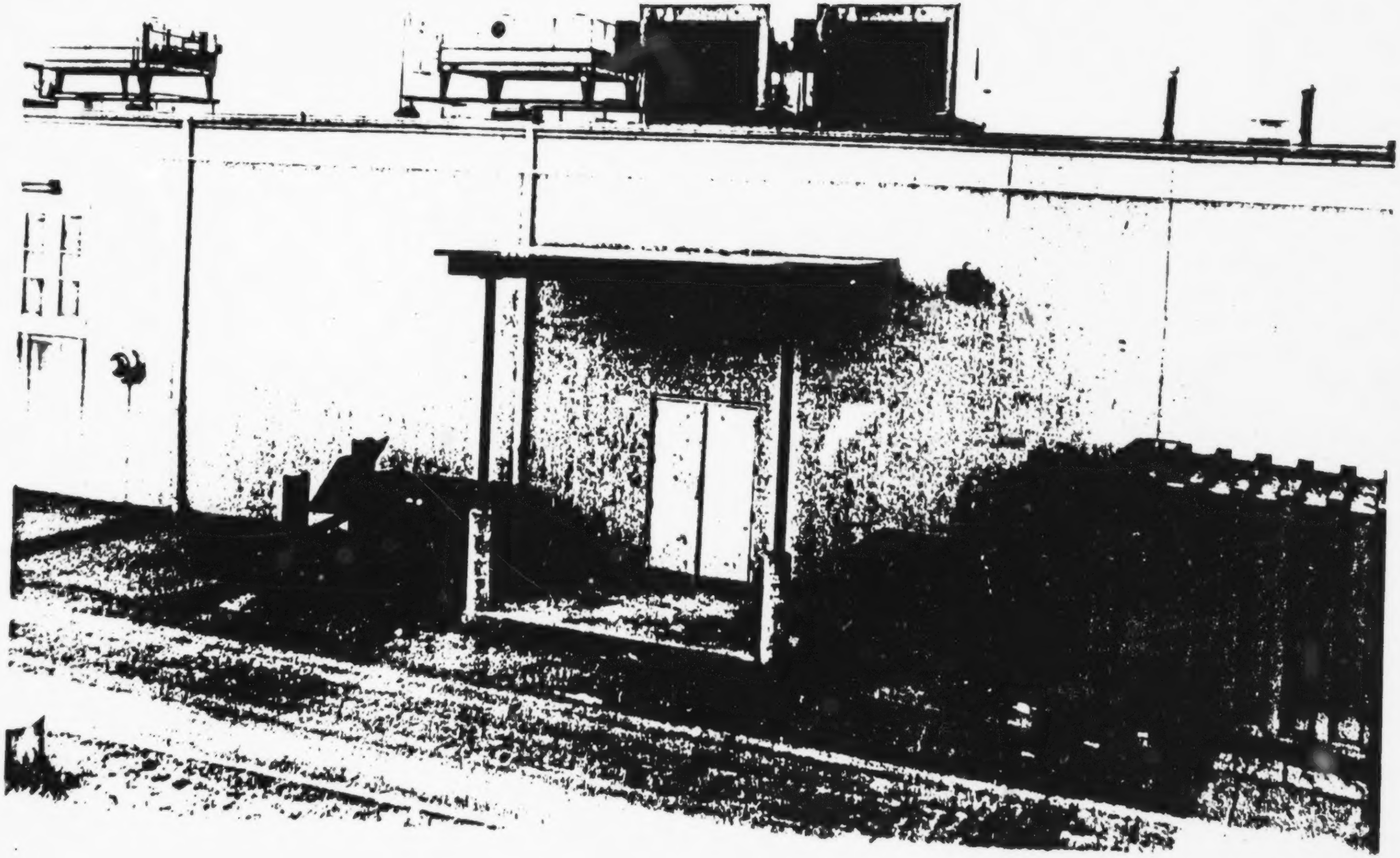
Grand Union Food Store
Ferndale, Maryland

A & P Food Store
Sun Valley, Maryland

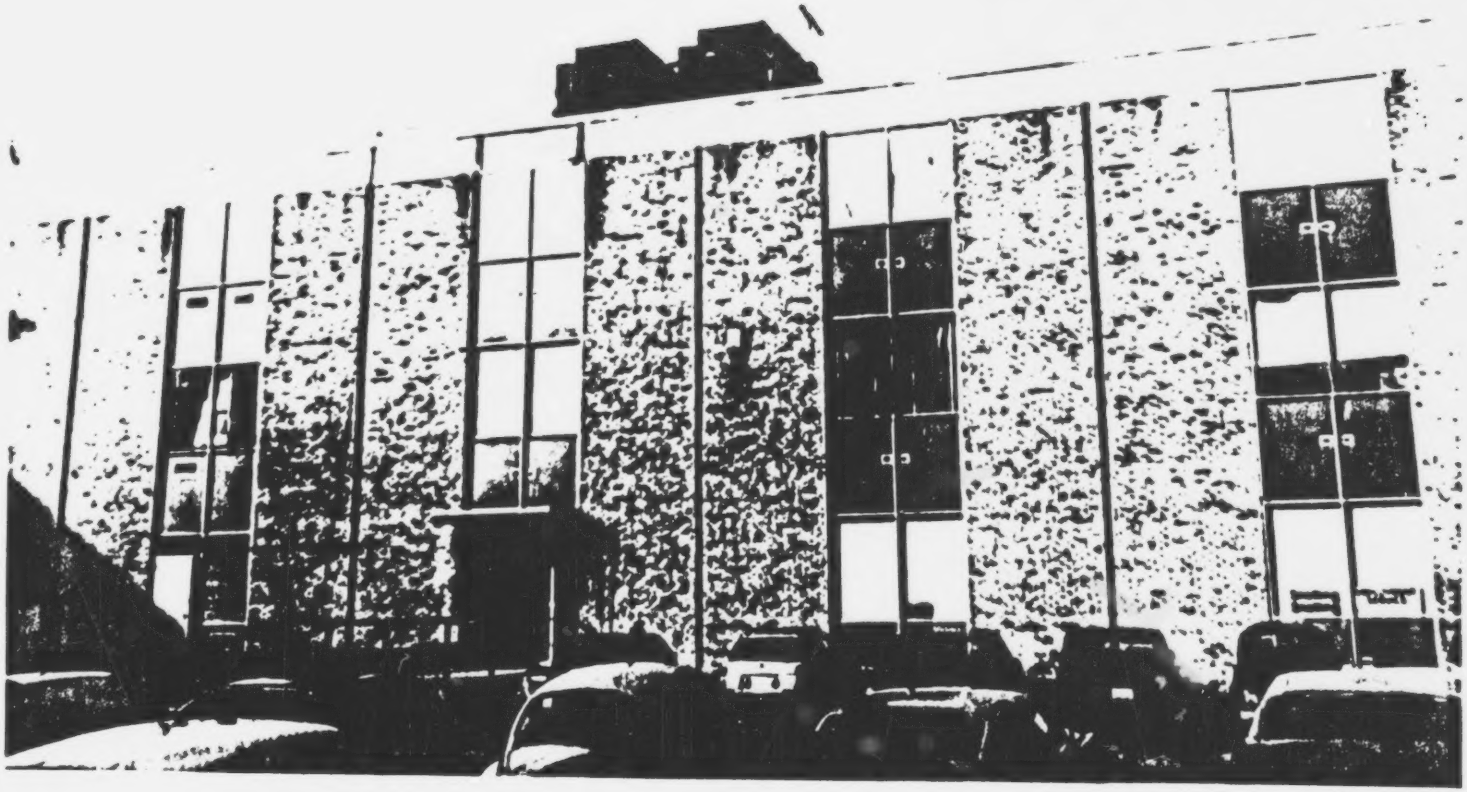


SMITH'S REFRIGERATION
MECHANICAL CONTRACTORS
254-8100

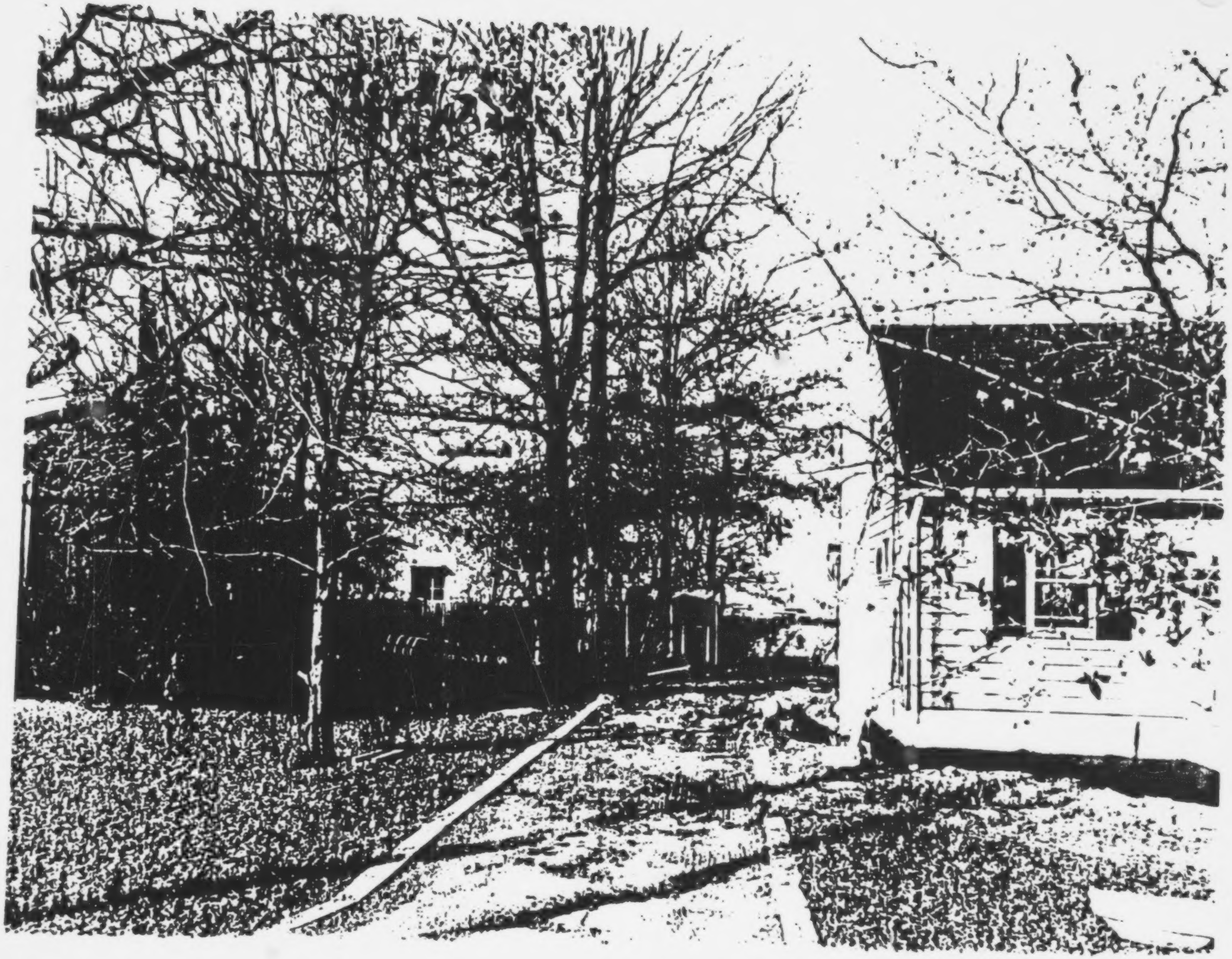
A & P Food Store
Sun Valley, Maryland
Carrier Condensing Units
View from Residential
Property Line



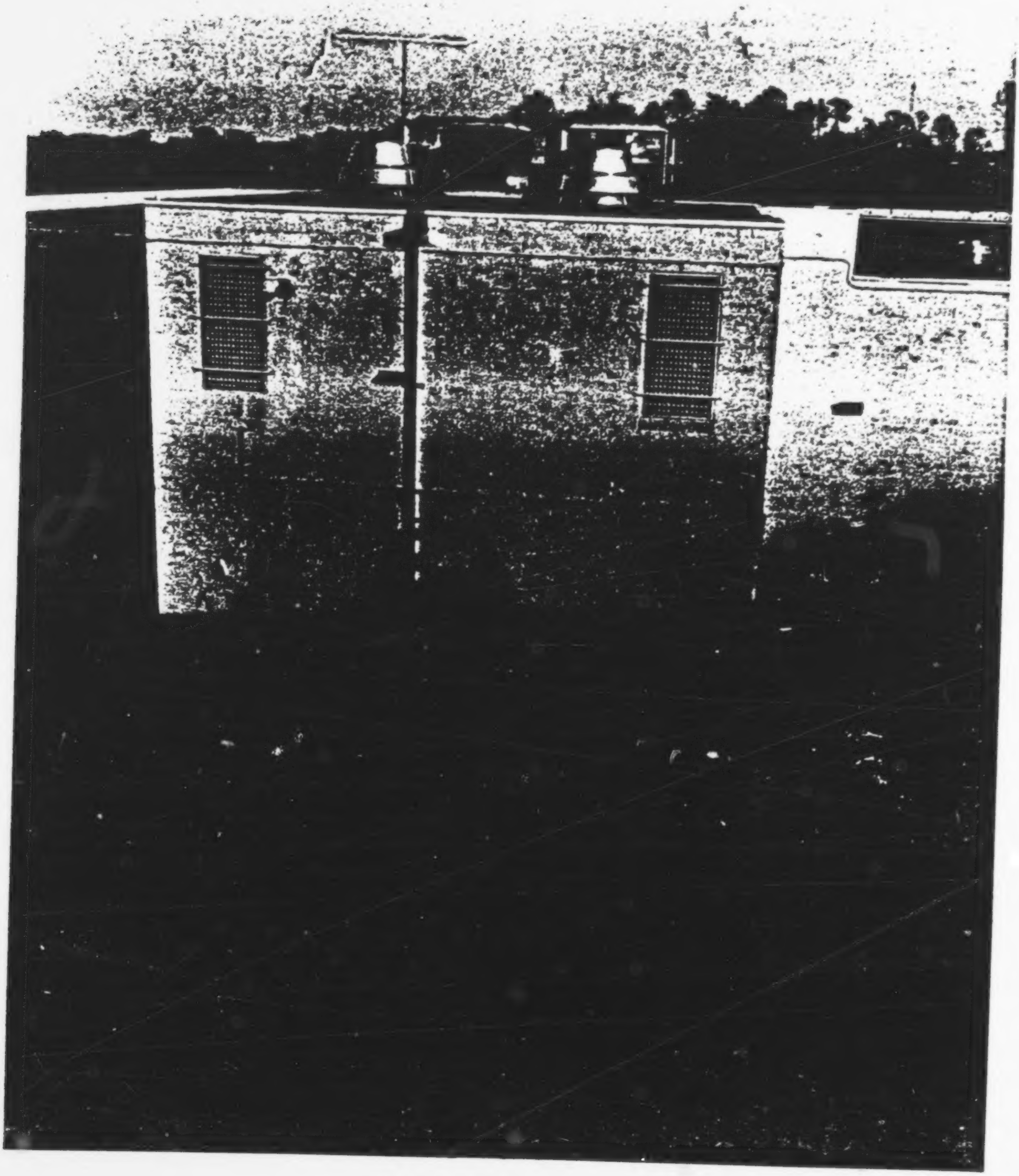
Grand Union Food Store
Ferndale, Maryland
McQuay Condensing Units



Aquahart Office Building
Harundale, Maryland
Acme Condensing Units



Residential Property Adjacent
Acushart Office Building
Harundale, Maryland

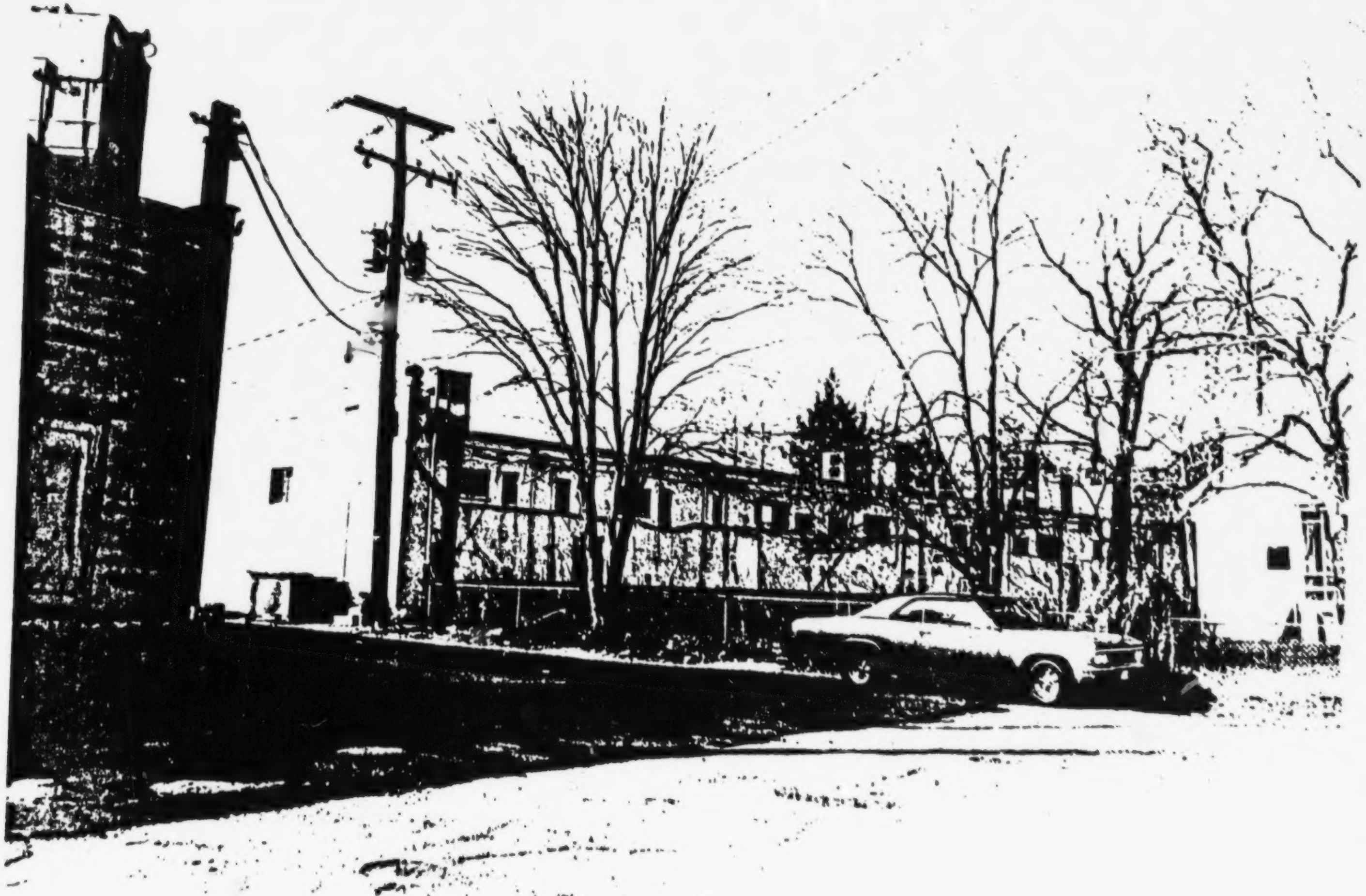


A & P Food Store
Arnold, Maryland
10 HP, Kramer & Carrier
Carrier Condensing Units

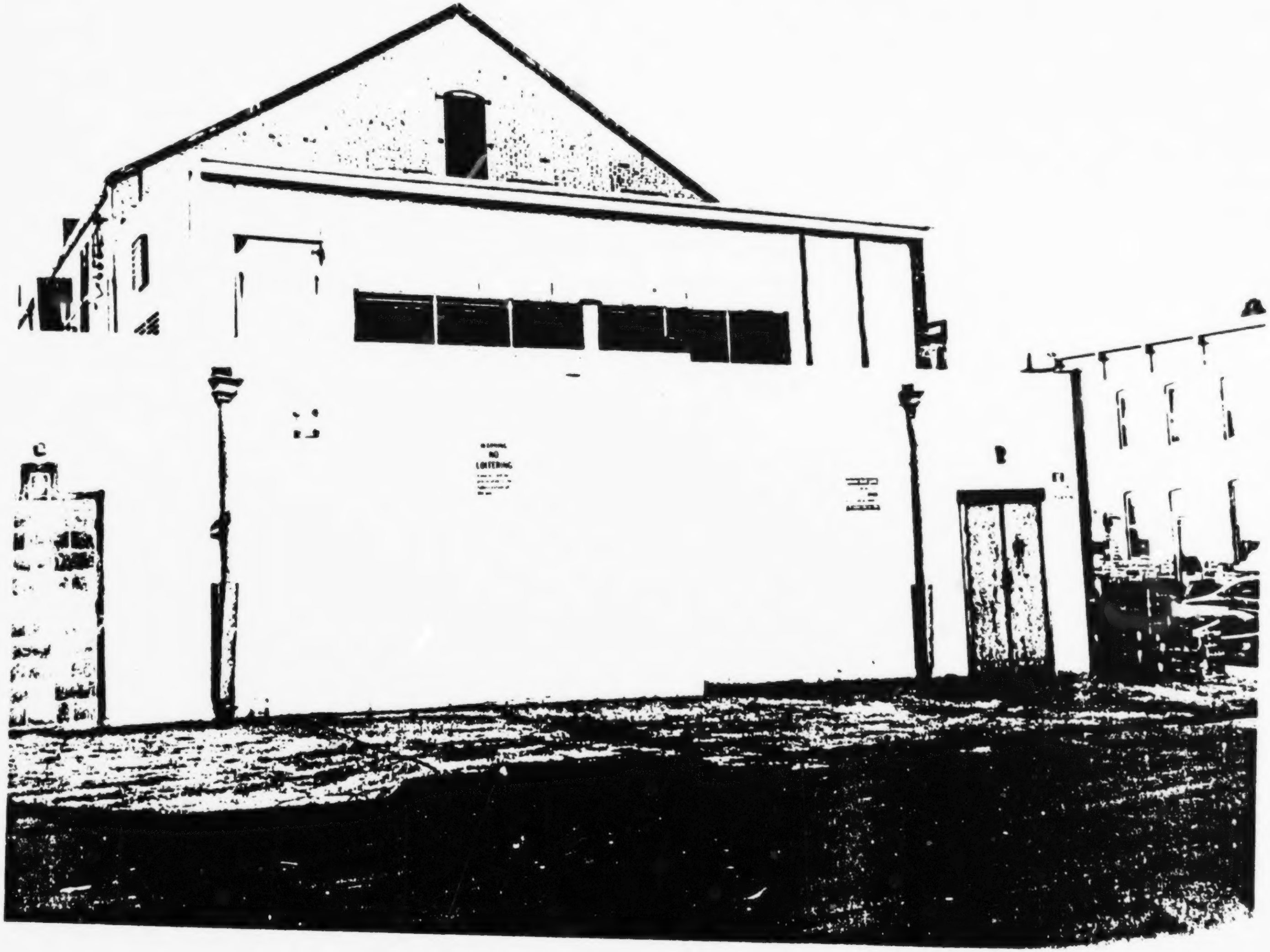
Royal Farm Store
Lake Shore, Maryland
Carrier Condensing Units

[illegible]

Shop & Save Food Market
Ferndale, Maryland
Marley Condensing Unit



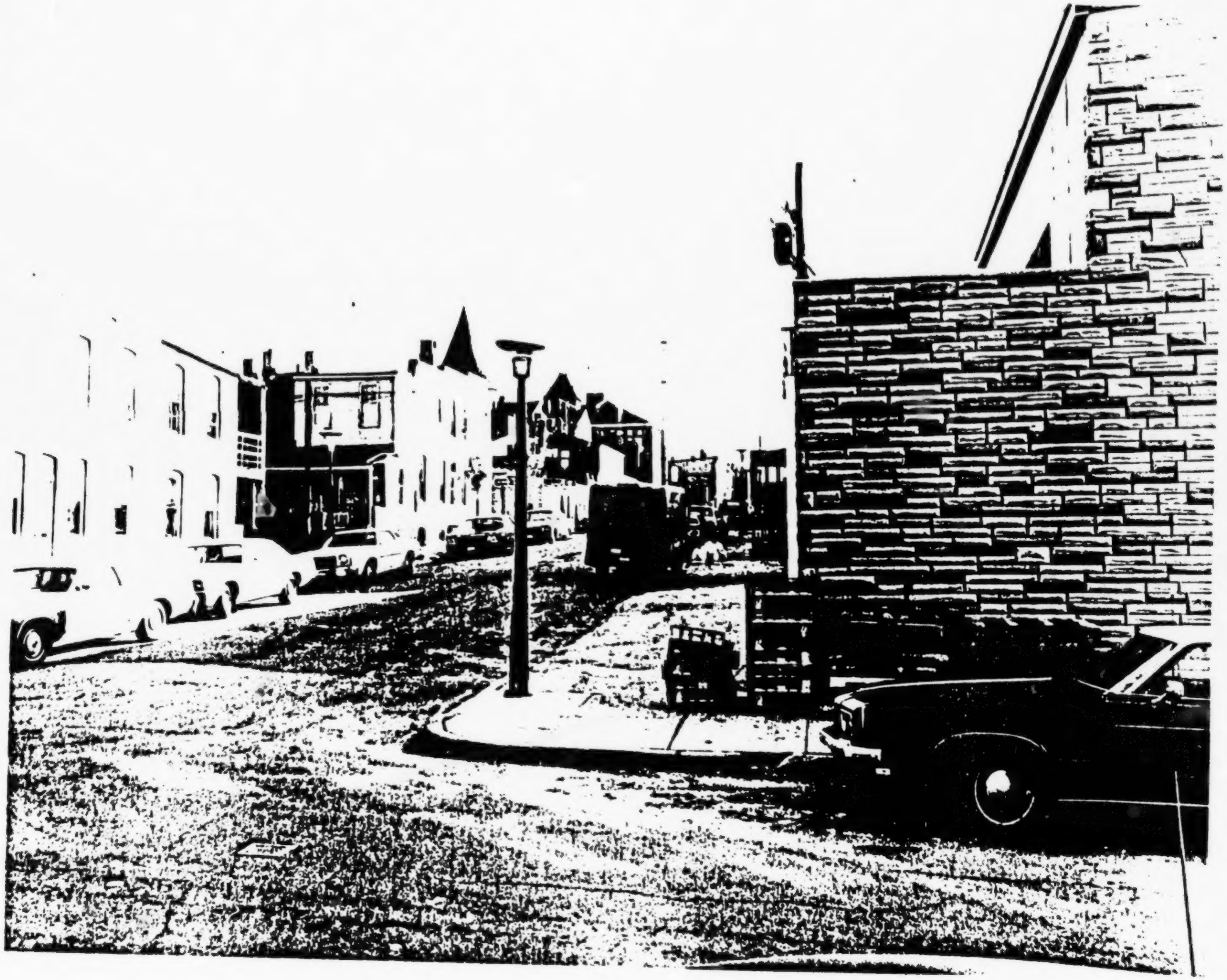
Residential Property Adjacent
Shop & Save Food Market
Ferndale, Maryland


NO
LOITERING

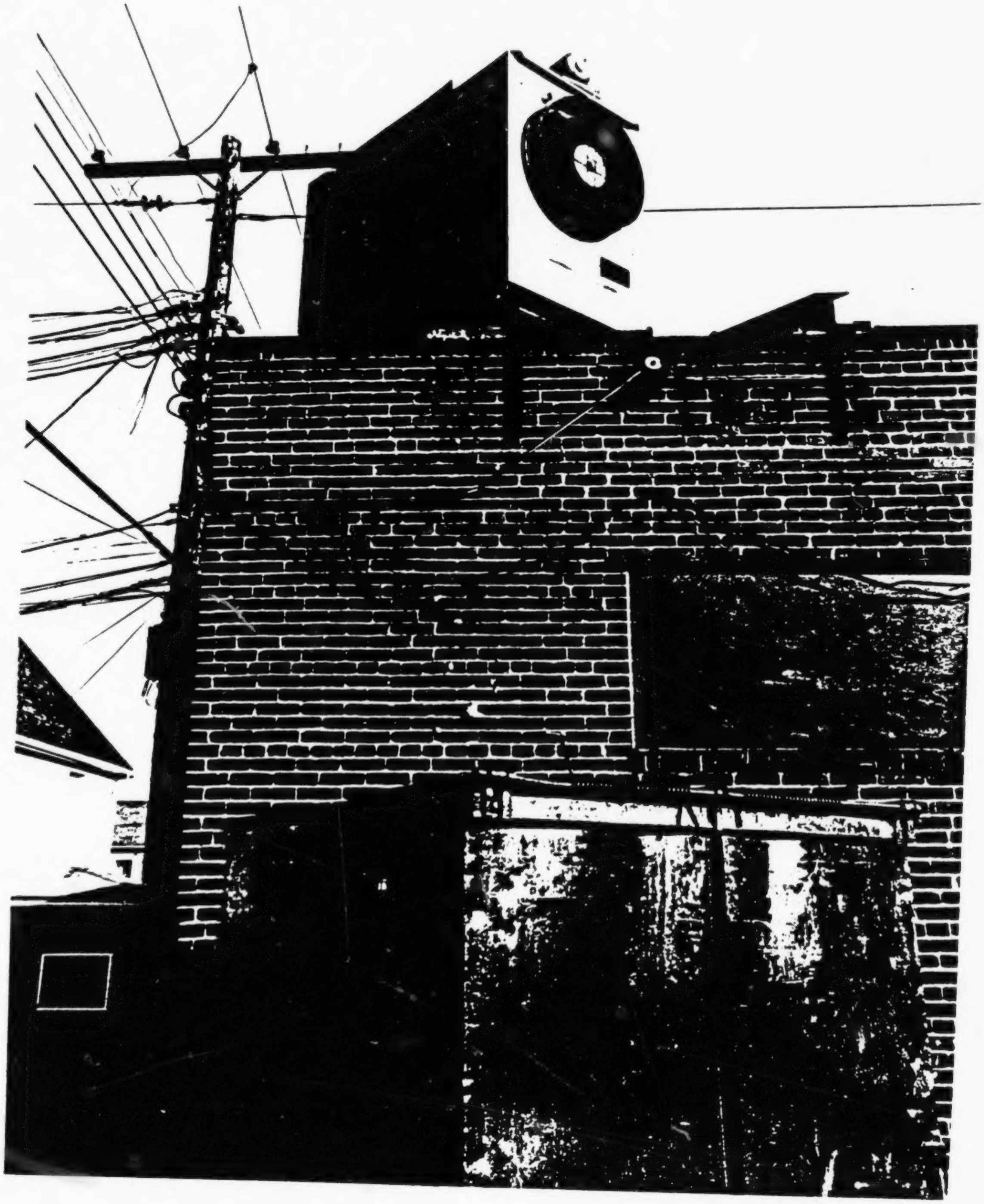
A & P Food Store
Baltimore City, Maryland
Huffman Condensing Units
In Enclosure

A & P Food Store
Arnold, Maryland

A & P Food Store
Baltimore City, Maryland
Carrier Condensing Unit

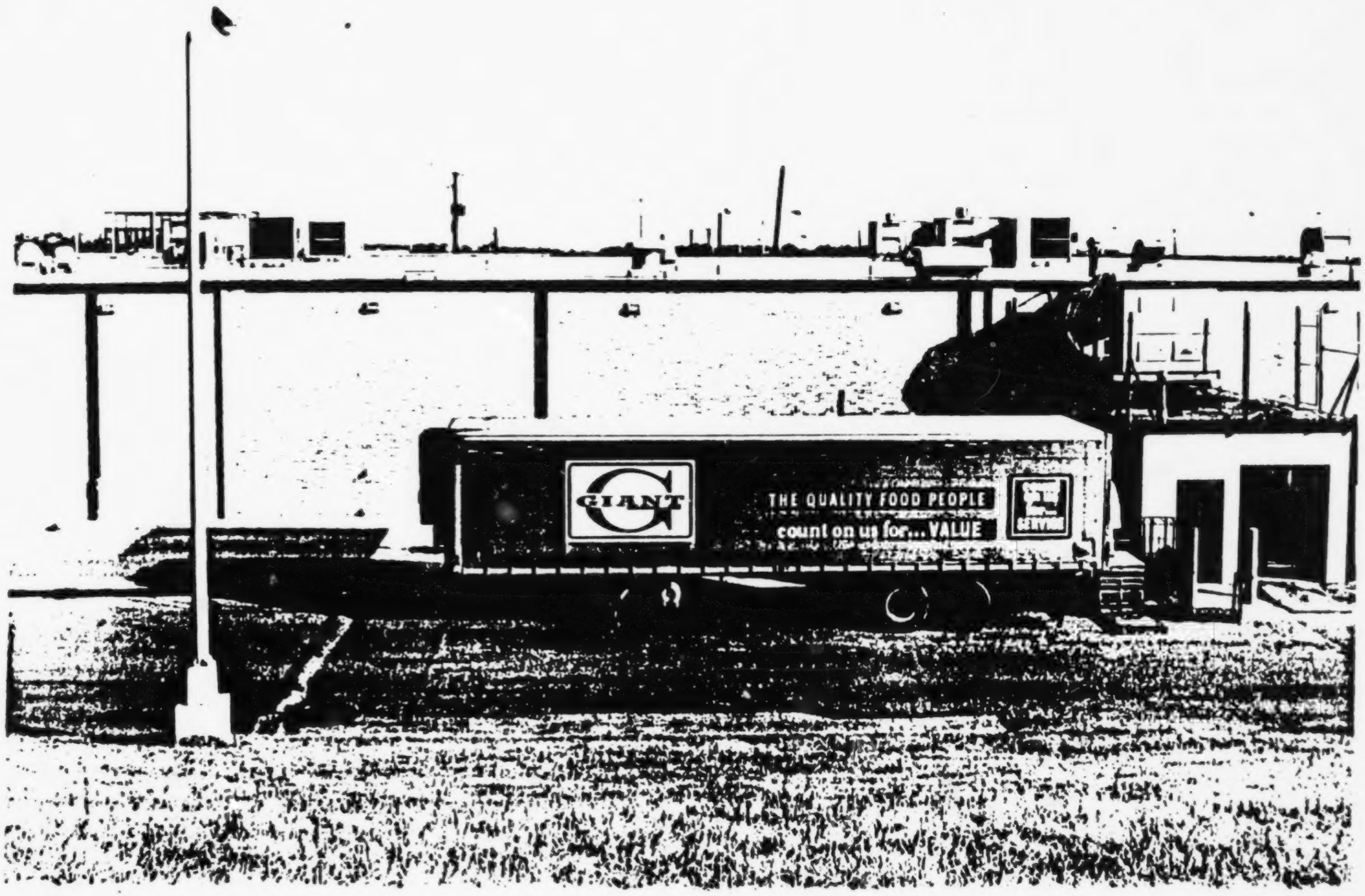


Residential Property Adjacent
A & P Food Store
Baltimore City, Maryland



A & P Food Store
Baltimore City, Maryland
Carrier Condensing Unit

Residential Property Adjacent
Giant Food Store
Glen Burnie, Maryland


GIANT
THE QUALITY FOOD PEOPLE
count on us for... VALUE
SERVICE

Giant Food Store
Glen Burnie, Maryland
Melco & Recold Condensing Unit

Appendix 4

State of Maryland's Report of Observation of Violation Form:

MARYLAND STATE DEPARTMENT OF HEALTH AND MENTAL HYGIENE
ENVIRONMENTAL HEALTH ADMINISTRATION
Bureau of Air Quality and Noise Control
O'Conor Building
201 W. Preston Street
Baltimore, Maryland 21201

REPORT OF OBSERVATION OF VIOLATION

Date ______________________

Time ______________________

Name of Violator ______________________

Address ______________________

______________________ County ______________________

Regulation(s) Violated ______________________

☐ Air
☐ Noise

You are hereby notified that an observation has been made of a violation of the Pollution Control Regulations of the State of Maryland. The Regulation was violated in the following manner and extent:

____

____

____

____

____

____

Failure to correct (this, these) violation(s) could subject you to prosecution and penalty.

Description of Weather __________ Estimated Wind Speed ______ mph Direction __________

Observer's Location ______________________

____
Name of Observer

____
Phone Number

AQC-20 Revised 9-1-75

Appendix 5

Sample Letter of Inquiry Regarding Operational Use Curfews and Addresses of Persons Contacted:

State of Maryland

DEPARTMENT OF HEALTH AND MENTAL HYGIENE
ENVIRONMENTAL HEALTH ADMINISTRATION
P.O. BOX 13387
201 WEST PRESTON STREET
BALTIMORE, MARYLAND 21203
PHONE • 301-383-2727

NEIL SOLOMON, M.D., PH.D.
SECRETARY

DONALD H. NOREN
DIRECTOR

June 6, 1978

Dear Sir:

I would like to solicit your assistance in obtaining current information on certain operating characteristics of air conditioning systems for commercial buildings. Information is specifically needed in regard to nighttime shut down and reduced cooling effort. Your knowledge on the following items will be quite helpful:

1. Is there a net savings of energy or money obtained through nighttime shut down or reduced cooling effort?
2. Are there buildings where nighttime shut down or reduced cooling effort may not be effectively used?
3. If nighttime shut down or reduced cooling effort is effective, what building and/or operating characteristics would one use to predetermine the degree of savings?

Thank you for your assistance in this matter.

Sincerely yours,

Thomas A. Towers, Chief
Division of Noise Control

TAT:dp

SAMPLE LETTER OF INQUIRY

Addresses of Parties From Which Information was Solicited

A. Manufacturers:
Mr. George D. Hudelson
Vice President - Engineering
Director, Research Division
Carrier Corporation
Carrier Parkway
Syracuse, New York 13201

Mr. N. R. Patterson
Manager, Application Engineering
The Trane Company
LaCrosse, Wisconsin 54601

B. Utilities:
Mr. Gary R. Fuhrman
Baltimore Gas & Electric Company
Electric Engineering Department
Environmental Engineering
1020 Gas & Electric Building
Baltimore, Maryland 21203

Mr. Norman F. Allard
Manager of Air Quality
Potomac Electric Power Company
1900 Pennsylvania Avenue, N.W.
Washington, D.C. 20006

Mr. Donald B. Tenant
Manager, Environmental Control
Allegheny Power Service Corporation
800 Cabin Hill Drive
Greensburg, Pennsylvania 15601

Mr. Bob Matthews, General Engineer
Delmarva Power & Light Company
P.O. Box 1739
Salisbury, Maryland 21801

C. Other
Mr. John P. Reardon
Assistant Director
Government and Consumer Affairs
Air Conditioning & Refrigeration Institute
1815 North Fort Myer Drive
Arlington, Virginia 22209

Appendix 6

Responses to Inquiries Regarding Operational Use Curfews:

Carrier
Corporation

George D. Hudelson
Vice President
Engineering and Research

June 13, 1978

Mr. Thomas A. Towers, Chief
Division of Noise Control
State of Maryland
Department of Health and Mental Hygiene
Environmental Health Administration
P. O. Box 13387
201 West Preston Street
Baltimore, Maryland 21203

Dear Mr. Towers:

This is to acknowledge receipt of your letter requesting information on operating characteristics of air conditioning equipment for commercial buildings.

Since we manufacture several different types of air conditioning products for commercial buildings, and since the type of application, the building size, the nature of building load variation, types of control schemes, etc., may vary significantly, there is no simple answer possible for the questions posed in your letter.

To the extent possible, however, we will attempt to provide some comments which may be helpful to you. In order to do this, I have passed your letter on to the appropriate persons in our manufacturing divisions for response. You can expect a reply in due course.

Thank you for your interest.

Very truly yours,

George Hudelson

George D. Hudelson

GDH/jr

Carrier Parkway
P.O. Box 4808
Syracuse
New York 13221

Number One
Air Conditioning
Maker

July 19, 1978

Mr. Thomas A. Towers
Division of Noise Control
Department of Health and Mental Hygiene
Environmental Health Administration
P.O. Box 13387
201 West Preston Street
Baltimore, Maryland 21203

Dear Mr. Towers:

The questions in your letter of June 6, 1978 to Mr. George D. Hudelson are the type for which the answers are usually ver clear and very simple; but only after someone has spent a great deal of time in a detailed analysis of specific application. There are, however, some general guidelines which should be helpful in determining whether or not reduced cooling effect warranted further analysis.

The attached sketch shows the night set back situation graphically for the cooling mode. Energy and, therefore, dollars are always saved during operation at the higher thermostat settings (reduced cooling effect period.) The key is whether the recovery period consumes more than you've saved. Several factors affect this and not all of them are under your direct control. In general, the amount and rate at which you use energy are under your control while the cost of that energy is not. On this basis, let's split question number one into two parts and address each part separately.

For the first part, let's address energy. The energy saved can be approximated as follows:

$$\text{Btu}_{\text{saved}} = \text{Bldg. load per degree } \Delta T \times (\text{normal temp.} - \text{set back temp.}) \times \text{hrs.}$$

The building load per degree ΔT is a function of building design (i.e., how well insulated, how much glass, orientation, etc.) and can be approximated by dividing the design load by the design ΔT.

Continued -----

Division of
Carrier Corporation
Carrier Parkway, Syracuse, New York 13221 • Telephone (315) 432-6000

For example:

$$\frac{\text{Design Load}}{\text{(Outdoor design condition - Indoor design condition)}}$$

$$= \frac{240{,}000\ \text{BTUH}}{(98-72)\,^{\circ}\text{F}} = \frac{240{,}000}{26} = 9230\ \frac{\text{BTUH}}{^{\circ}\text{F}}$$

The energy required to recover can be approximated as follows:

$$\text{BTU} = 0.197 \times \text{gross area (ft.}^{2}) \times \text{(normal temp. - set back temp.)}$$

This approximates the BTU's required to cool the air volume in the structure back down to the normal temperature. It does not account for the thermal mass of the structure or anything inside. Basically, it would satisfy the thermostat on the first cycle. The next few cycles of the thermostat would be shorter than normal because of the extra internal structure load.

In an existing building, the recovery time will be established by the installed capacity of the equipment and can be approximated as follows:

Bldg. Load at reduce cooling - Unit capacity = Excess capacity

$$\frac{\text{BTU required to recover}}{\text{Excess capacity}} = \text{Recovery time}$$

In a new building the recovery time can be specified and the equipment sized accordingly. The shorter the recovery time, the greater the excess capacity required.

The second part of the question - dollars - is a function of equipment operation and the utility rate structure. It is not impossible to save energy and to spend significantly more dollars. Here again the recovery area is critical. During the reduced cooling period, dollars as well as energy will be saved; however, many utilities have instituted or are looking at time of day rates and in this case, the energy saved is the lowest cost energy. In the recovery period, the rate of consumption as well as the total consumption must be looked at since most commercial power rates include demand charges.

Continued -----

In general, if the system operation in the recovery period adds to the demand peak, there is a good chance that the net dollars will be minimal or negative. The first approximation of the absolute value of these costs can be obtained by using the energy requirements outlined above and the local utility rate structure.

With regards to question #2, I know of no generic type of building (i.e., hospital, restaurant, office, etc.) which inherently is unsuitable for night set back. Building usage patterns have more of an effect than generic class.

Question #3 - I believe this comes down to how do I determine how much money I can save. This, in turn, generates a second question which involves how sure you want to be of the answer. An approximation can be arrived at by using the estimates of energy and dollar savings and the number of hours at the reduced cooling conditions; however, this really only gives an indication whether or not night set back warrants further analysis. An estimate with any reasonable accuracy requires a detailed analysis of the building load profile, usage pattern and local rate structure.

I realize that this amounts to answering every question with "yes" and "no", but there is no single answer which is right for the majority of the cases. The only general statement that can be made is that in most cases it should save energy - it may or may not save dollars and it may or may not result in satisfactory space conditions.

Very truly yours,

Richard Martini

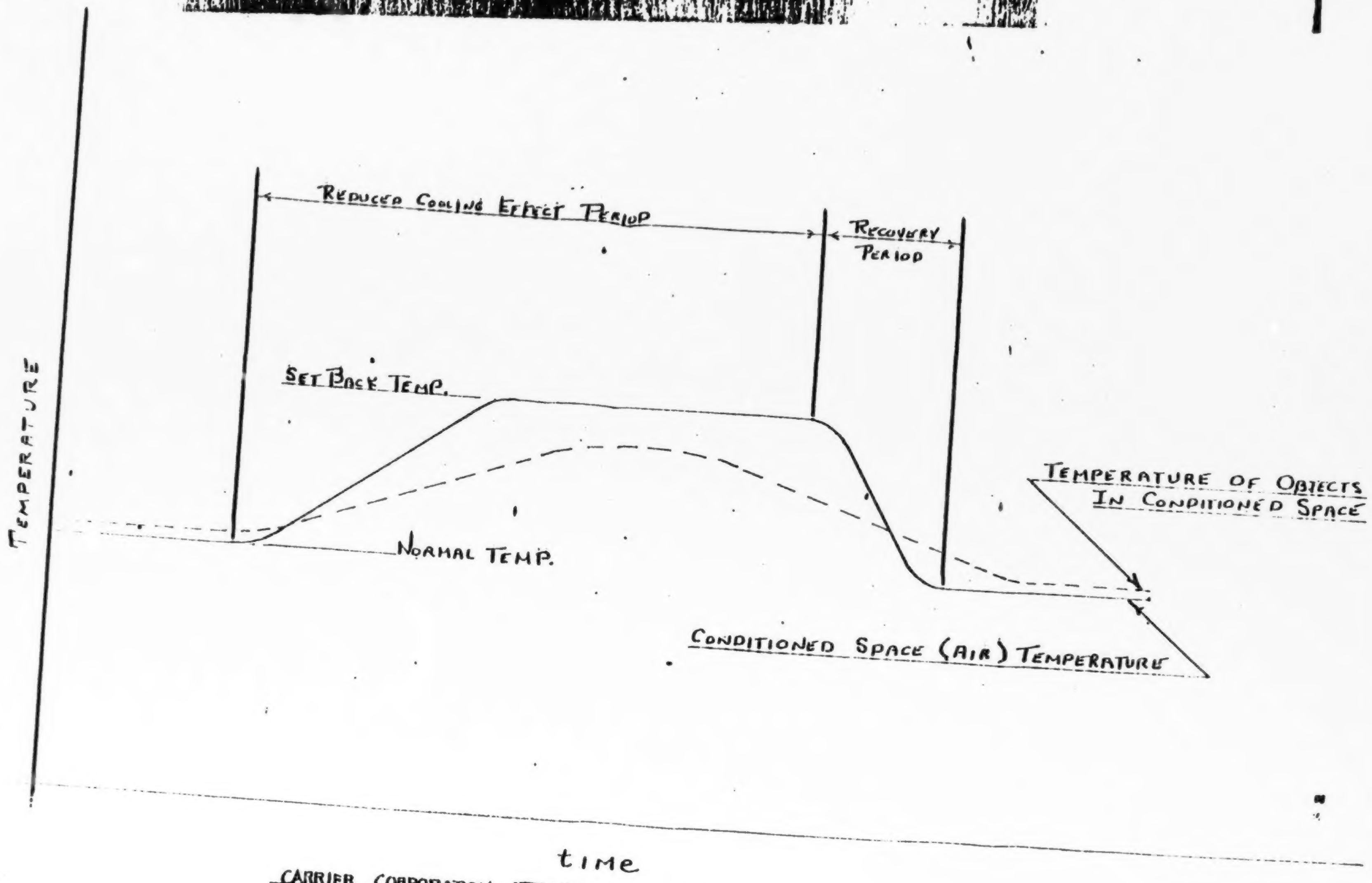
Richard M. Martini, Manager
Energy Systems
Commercial Marketing

RMM/cm

Attachment

cc: Mr. Richard Chapman
Mr. George Hudelson
Mr. William Wren

RECEIVED
JUL 24 1978
DIVISION OF
NOISE CONTROL



CARRIER CORPORATION ATTACHMENT 7-19-78

6/27/78

TRANE
AIR CONDITIONING

THE TRANE COMPANY
LA CROSSE, WISCONSIN 54601 (608) 782-8000
TELEX: 29-3415 TWX: 910-287-2579 CABLE: TRANE

June 16, 1978

State of Maryland
Department of Health and Mental Hygiene
Environmental Health Administration
P. O. Box 13387
201 West Preston Street
Baltimore, MD 21203

Attention: Mr. Thomas A. Towers, Chief
Division of Noise Control

Reference: Your Letter of June 6

Dear Mr. Towers:

This will acknowledge receipt of your June 6 letter regarding information on nighttime shutdown and reduced cooling effort in buildings.

In the case of nighttime shutdown of heating, ventilating and air conditioning systems, there is a very definite energy savings involved. In many buildings that utilize a perimeter heating system, it is possible to shut off the internal air conditioning system for extended periods of time during nonoccupancy and save considerable amounts of energy.

Reduced cooling effort on certain types of air conditioning systems can actually increase the amount of energy that that system will use. A good example of this is what we call a terminal reheat system where, if the thermostats were set up to 78° and we experience a load reduction, this loss of load must be replaced with reheating energy to temper the supply air to the conditioned space. If the thermostat is set at 78°, the reheating energy would be substantial if the same air movement were maintained.

If in the same building we were utilizing a variable air volume system and set the thermostats up to 78° in lieu of say 75°F, the energy reduction could be substantial since we are now varying the air volume and, in doing so, would reduce the air moving energy associated with that kind of system on reduced cooling effort.

The other consideration is the mass of the building. Generally speaking, heavier buildings have a much longer soak time and, therefore, it is possible to shut off the heating, ventilating and air conditioning system on an 8:00 a.m. to 5:00 p.m. building prior to 5:00 p.m. since the building will take a greater period of time to soak the temperature up or down.

In like manner, it may be necessary to start the equipment prior to occupancy to pull the building temperature back down. Ideally, this setup operation would take place at other than peak energy use times to reduce the demand charges on the building energy system.

The effect of nighttime shutdown of a building or reduced cooling effort can be analyzed on a computerized energy and economic analysis program such as the Trane air conditioning economics program.

A study of this nature will compare various modes of operation of the building and its service systems quite effectively to quantify the degree of savings that are available to the building owner.

If you are interested in pursuing this further, we suggest that you contact our Baltimore office who is capable of giving you additional information on the Trane Air Conditioning Economics program.

If we can be of further assistance to you, please feel free to contact us.

N. R. Patterson, Manager
Applications Engineering

P.S. The address of our Baltimore, Maryland office is:

2011 Greenspring Drive
Timonium, MD 21093

Attention: Chris N. Cuddeback

Telephone: 301 252-8100

BALTIMORE GAS AND ELECTRIC COMPANY
P.O. BOX 1475
BALTIMORE, MARYLAND 21203

ELECTRIC ENGINEERING
DEPARTMENT

June 8, 1978

Mr. Thomas A. Towers
Chief, Division of Noise Control
Department of Health & Mental Hygiene
P. O. Box 13387
201 West Preston Street
Baltimore, MD 21203

Dear Mr. Towers:

This is to advise you that in response to your letter of June 6, 1978, requesting certain operating characteristics of air conditioning systems, your questions have been referred to our Energy Services Department.

In discussing the nature of your questions with Energy Services they prefer to discuss some of these matters with the major air conditioning manufacturers. Accordingly, it may be several weeks until we respond to your request.

We will attempt to respond to your request as soon as possible.

Very truly yours,

G. R. Fuhrman
Chemist
Electric Engineering Department

GRF:eml

RECEIVED
JUN 13 1978
DIVISION OF
NOISE CONTROL

BALTIMORE GAS AND ELECTRIC COMPANY

Energy Services

July 13, 1978

Mr. Thomas A. Towers, Chief
Division of Noise Control
Dept. of Health & Mental Hygiene
P.O. Box 13387
201 West Preston Street
Baltimore, Maryland 21203

Dear Mr. Towers:

As you requested, in your letter of June 6, 1978, we have considered operating characteristics of air conditioning systems for commercial buildings. Our response to your questions are as follows:

1. Q.-Is there a net savings of energy or money obtained through night time shut down or reduced cooling effort?

   A.-There are mixed opinions about the answer to this question. Our feeling is that savings can be accomplished by shutting down or setting up air conditioning during night time hours. We recommend to customers, however, that if the weather report shows an extremely hot day, that they not adjust the air conditioning. In other words, set it up or turn it off most times during the summer except for extremely warm periods.

2. Q.-Are there any buildings where night time shut down or reduced cooling effort may not be effectively used?

   A.-Any building which has more than one shift or any late evening or night time operation could not benefit from night shut down. Examples would be

Business Location
Phone 265-7500
1508 Woodlawn Drive · East of Beltway at exit 17

Mailing Address
P.O. Box 1475
Baltimore, Maryland 21203

industrial plants which work around the clock, residential buildings, such as high rise apartments, department stores and other retail stores which stay open to 9:30 or 10:00 at night.

3. Q.-If night time shut down or reduced cooling effort is effective what building and/or operating characteristics would one use to predetermine the degree of savings.

   A.-This question is very difficult to answer. Some of the controls companies have been attempting to arrive at computer models which would determine the results of night set up of cooling. Their studies are as of this time incomplete.

If you have any further questions, please do not hesitate to call or write.

Sincerely,

Edward K. Cassedy

Edward K. Cassedy
Sr. Energy Applications Spec.

EKC/rkj

cc J. W. Stout, Jr.
A. J. McCubbin
J. P. Bennett

RECEIVED
JUL 14 1978
DIVISION OF
NOISE CONTROL

POTOMAC ELECTRIC POWER COMPANY · 1900 PENNSYLVANIA AVENUE, N. W., WASHINGTON, D. C. 20068
(202) 872-2000

June 28, 1978

Mr. Thomas A. Towers, Chief
Division of Noise Control
State of Maryland
Department of Health and Mental Hygiene
Environmental Health Administration
P. O. Box 13387
Baltimore, Maryland 21203

RECEIVED
1978
DIVISION OF
NOISE CONTROL

RECEIVED
1978
DIVISION OF
NOISE CONTROL

Dear Mr. Towers:

Your letter to Mr. Allard with respect to obtaining information on certain operating characteristics of air conditioning systems for commercial buildings has been referred to me. There is only a minimum amount of factional infomation available because of the complexity and diversity of this market. For this reason, I have answered your questions in a general manner.

First, there are at least five factors that impact the feasibility of curtailing or shutting off an air conditioning system during hours of unoccupancy. The first is the type of building or occupancy. The type of building that you are dealing with has a considerable impact on the feasibility of shutting off the air conditioning system. For example in a Bowling Alley, which has a very high percentage of fresh air ventilation required during periods of occupancy, the set back or shutting off of the air conditioning system is typically advantageous, primarily because it reduces the very high ventilation load. A second factor is the sizing of the air conditioning system. In some cases the air conditioning is sized close to or somewhat less than the calculated heat gain. In this case shutting off an air conditioning system would often be found impractical because it may not be large enough to cool the building down to the desired temperature level in the morning when the building is to be occupied. Another factor is the type of air conditioning system and its control. some systems are designed, typically in very large buildings, for operating at a reduced level. For example, in our office building the perimeter chilled water system can be operated to reduce the heat gained through the exterior walls of the building and keep the building at a minimal temperature without operating the entire system. This gives us maximum economic operation and yet permits us to keep the building within a reasonable temperature range. The hours that a building is occupied is another factor. The greater the hours that the building is used the less feasible shutback will be found. The last factor is the time of the year. During the intermediate months when only minimal cooling is required it will be more feasible to shut off or reduce the cooling when the building is not occupied.

Mr. Thomas A. Towers
Page Two
June 28, 1978

Generally speaking we recommend to commercial building operators that unless they have extended hours of operation, more than 12, that a shutdown would be desirable. We recommend that the shutdown be designed considering the amount of time that will be required to permit the building to be pulled down to the desired temperature in the morning prior to occupancy. We would use a different approach for buildings of extended use, 14 to 18 hours or more, where the feasibility of shutting down the cooling system is questionable. In these cases the key factor is the ventilation load relationship during the occupied and unoccupied hours.

If you have any questions with respect to these matters, please let me know. We would be glad to review them with you at your convenience.

John H. Whitney

John H. Whitney

cc: N. F. Allard
K. M. McGrath

Appendix 7

Schedules G & T of Electric Service Rates:

GENERAL SERVICE—ELECTRIC

SCHEDULE G

Availability:
For use for all purposes.

Delivery Voltage: Service at Secondary Distribution Systems voltages, or at Primary Systems voltages (Rider 15).

Monthly Net Rates:

Demand Charge:

For the first 60 kW of billing demand	None
For the next 440 kW of billing demand	$3.26 per kW
For the excess over 500 kW of billing demand	$3.05 " "

Energy Charge:

For the first	60 kWh	8.68¢ per kWh
For the next	2,640 "	5.97¢ " "
For the next	6,800 "	4.18¢ " "
For the next	15,000 "	2.84¢ " "
For the next	75,000 "	2.34¢ " "
For the next	175,000 "	2.08¢ " "
For all over	274,500 "	1.67¢ " "

Fuel Rate Adjustment: Applies to all electricity supplied. (Rider 1)

Billing Demand: The maximum measured demand (Rider 11) in the 12 months ended with the current billing month if such demand is less than 75 kW; otherwise, the maximum measured demand for the month but not less than 75 kW; and in either event not less than two-thirds of the maximum billing demand, up to 200 kW, in the months of June to September, inclusive, of the preceding 11 months plus one-half of the excess (if any) of such maximum billing demand over 200 kW.

Minimum Charge (Net): $1.89 per month plus the Demand Charge, if any, and the Fuel Rate Adjustment on kWh supplied.

Late Payment Charge: Standard. (Sec. 7.4)

Payment Terms: Standard. (Sec. 7)

Term of Contract: One to 3 years, dependent upon extension and demand requirements (Rider 21), and thereafter until terminated by at least 30 days' notice from the Customer.

Subject to riders applicable as listed in Rider Index.

RIDERS

Riders applicable: 1, 2, 3, 8, 9, 11, 15, 17, 19, 21, 22, 23.

1. Fuel Rate Adjustment

The price of electricity for the current billing month is adjusted (to the nearest thousandth of a cent per kWh) to reflect the cost of fuel required to produce electricity.

The cost of fuel per kWh of sales is the quotient obtained by dividing (a) the sum of the costs charged to the following FPC accounts in the current month:

(1) Account 501—Steam Power Generation—Fuel and Account 547—Other Power Generation—Fuel as cleared through Account 151—Fuel Stock, plus
(2) Account 518—Nuclear Power Generation—Nuclear Fuel Expense, plus
(3) The energy charges and/or credits in Account 555—Other Power Supply Expenses—Purchased Power, plus
(4) Account 557.1—Power Production Expenses—Other Expenses Fuel Cost Adjustments, by (b) the total kWh of Baltimore Company sales for the current billing month.

The "cost of fuel per kWh of sales" is adjusted by the Gross Receipts Tax rate in effect during the current month, expressed as a decimal, to determine the Fuel Rate Adjustment for the current month.

The Fuel Rate Adjustment is based on the estimated cost of fuel per kWh of sales for the current billing month. The reconciliation to reflect actual costs and sales is made in the second succeeding billing month.

(Note: The cost of fuel, the total kWh of Baltimore Company sales, and any Fuel Rate Adjustment are filed monthly with the Public Service Commission of Maryland.)

11. Measured Demand

The measured demand is the Customer's rate of use of electric energy as shown by or computed from readings of the Company's demand meter in any 30-minute interval. In billing under Schedule G it is adjusted to the nearest half kW.

Where service is used in such a manner that the measured demand as defined above does not properly reflect the capacity which the Company is required to provide, the demand may be estimated by the Company, so as to reflect such capacity.

Where the power factor is found to be less than 90%, the Company reserves the right to base the demand on 90% of the kilovolt-amperes (kVa) instead of on the kW.

21. Term of Contract of Schedule G

The initial term of contract is 3 years where additional main facilities are required for supply, or where the estimated maximum Billing Demand exceeds 200 kW. Otherwise, the term of contract is one year.

23. Billing in Event of Service Interruption

No adjustment in billing will be made by reason of failure or interruption of the supply of electricity where such interruption is due to storm, lightning, fire, flood, drought, strike or any cause beyond the control of the Company, except interruptions caused by wilful default or neglect on its part.

SERVICE AT 13,200 VOLTS AND OVER

SCHEDULE T

Availability:

For use for all purposes, for demands of 200 kW or more.

Delivery Voltage: Three-phase, 13,200 volts and over.

Monthly Net Rates:

Demand Charge:

For the first 200 kW (or less) of billing demand	$ 568
For the next 1,800 kW of billing demand	$2.82 per kW
For the excess over 2,000 kW of billing demand	$2.43 " "

Energy Charge:

For the first 50,000 kWh	2.14¢ per kWh
For the next 250,000 "	1.94¢ " "
For the next 300 kWh per kW of billing demand	1.44¢ " "
For the next 200 kWh per kW of billing demand	1.25¢ " "
For all over	1.11¢ " "

Fuel Rate Adjustment: Applies to all electricity supplied. (Rider 1)

Billing Demand: The maximum measured demand (Rider 11) for the month, but not less than one-half of the maximum billing demand in the months of June to September, inclusive, of the preceding 11 months.

Late Payment Charge: Standard. (Sec. 7.4)

Payment Terms: Standard. (Sec. 7)

Terms of Contract: Five years and thereafter until terminated by at least 30 days' notice from the Customer.

Subject to riders applicable as listed in Rider Index.

(B) Energy Charge (Available under Schedule G at Secondary Distribution Systems voltages only, in addition to the Demand Charge provision where applicable)

Where the connected load of the electric heating equipment is 5 kW or over, and where the Customer elects to supply such equipment on a separate circuit (or circuits) provided by him apart from his other requirements for electric service at the premises, the Company will separately meter such heating use and in the billing months of October to May, inclusive, such monthly metered use will be billed as end use in the Customer's total billing for electric service at an energy charge rate not higher than 2.26¢ per kWh in lieu of any higher rates otherwise applicable to all or part thereof, provided such rate does not apply to the first 500 kWh of the Customer's total requirements in the month. Self-contained combination equipment (such as heat pumps) and air handling and water circulating equipment which are exclusively used seasonally for electric heating and for cooling may be connected to the separate meter; also, to facilitate economy of the Customer's wiring, other air cooling equipment may be connected to that meter provided the connected load of the cooling equipment does not exceed the connected load of the heating equipment likewise connected at any time. Meters installed for less than a continuous period of 12 months to separately measure heating uses are subject to connection and disconnection charges.

11. Measured Demand

The measured demand is the Customer's rate of use of electric energy as shown by or computed from readings of the Company's demand meter in any 30-minute interval. In billing under Schedule G it is adjusted to the nearest half kW, and under Schedule T it is adjusted to the nearest whole kW.

Where service is used in such a manner that the measured demand as defined above does not properly reflect the capacity which the Company is required to provide, the demand may be estimated by the Company, so as to reflect such capacity.

Where the power factor is found to be less than 90%, the Company reserves the right to base the demand on 90% of the kilovolt-amperes (kVa) instead of on the kW.

12. Night and Holiday Demand

The measured demand on Saturdays, Sundays and the following holidays and during the night hours from 9 p.m. to 8 a.m. is reduced one-third in billing under Schedule T: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Election Day (National and State only), Thanksgiving and Christmas, and the Monday following such of these as fall on Sunday.

13. Initial Demand

During the first 6 months of service under Schedule T, the Billing Demand may be less than 200 kW but in that event is not subject to decrease and the Demand Charge is $2.84 per kW of such demand. When it reaches 200 kW, the provisions of this Rider no longer apply.

14. Demand Proration

During the first 6 months of the initial term of a contract for service, or by reason of the installation of additional equipment at any time and upon the Customer's request prior to the increase, the measured demand for billing purposes will be prorated under the following conditions:

> The billing month is divided into three periods consisting of the first 10 days, the second 10 days, and the remaining days of the month. If the demand of the second or third periods individually, or the higher demand during the combined second and third periods, increases at least 10% over both (1) the demand of the preceding period of the billing month and (2) the maximum Billing Demand of the preceding month, the Billing Demand for the month is the average of the demands determined for each such period or periods weighted on the basis of applicable thirds of the month.

The above provisions are not applicable to a part-month Billing Demand of less than 200 kW, but such demands are adjusted to 200 kW to obtain the benefits of proration under this Rider.

THE PROBLEM

This brochure describes noise and its effects. It was prepared to assist you in understanding noise problems and reducing the effects of your air conditioning and refrigeration equipment on your neighbors. Through concerned selection of equipment, proper placement and good maintenance practices, you can contribute to a quieter community.

One by-product of our helter-skelter society is sound. Not sound that is soothing and pleasant, but sound that is unwanted—a constantly increasing din. NOISE IS UNWANTED SOUND.

The United States Environmental Protection Agency estimates that some16 million people in the United States already are victims of hearing loss directly attributable to exposure to excessive noise. Further, hearing loss is a major cause of industrial injury, compensation for which runs into the millions of dollars.

Add to this the cost of annoyance, lost sleep, the inability to talk or listen comfortably, loss of use of property, and declining property values attributable, at least in part, to environmental noise and the problem increases dramatically for an estimated 40 million Americans.

WHAT IS NOISE?

Noise, or sound is produced by any number of sources which set up vibrations in the air around us, which, in turn are received by our ears and interpreted by our brain.

The major characteristics of noise are intensity, frequency, and duration. These are measured in decibels, Hertz, and the customary units of time.

A noise level of 0 decibels represents the weakest sound that can be heard by a young person with excellent hearing. At the other extreme, NASA produced a level of 210 dB with one of its rockets in 1969. The following chart shows the relative intensity of some sounds in decibels. An increase of 10 dB is perceived by the ear as being approximately twice as loud.

Noise Levels—dBA

140—
Threshold of pain
130—
Jet plane at takeoff at 200′
120—
Discotheque
110—
Jackhammer at 6′
100—
Pushing a power mower
90—
Garbage truck at 200′
80—
Traffic, beltway at 50′
→ 70—Condensing Unit at 20′
Automobile pass-by at 50′
60—
Conversational speech
50—
Rural setting
40—
Library
30—
Leaves rustling
20—
Normal breathing
10—
0—Threshold of hearing for youth

Most noise is a combination of sounds having various frequencies. Young healthy ears can hear sounds from approximately 20 to 20,000 Hertz, or cycles per second. Human ears are most sensitive in the 500-6,000 Hz range. Low frequency noise is usually less offensive than high frequency noise.

WHY THE CONCERN?

Sound waves travel through the air and set in motion the ear drum and the small bones or ossicles of the middle ear. The motion of the ossicles produces vibrations in the inner ear's sensory organ, the cochlea, which are transmitted to the brain to be perceived as sound or possibly noise. The hair cells, a critical link in the hearing process, cannot be restored following excessive sound exposure.

There is an intricate human emotional and psychological response to sound that can vary between the extremes of pleasure and fear. Some responses may be due to the information conveyed by the sound or to prior experiences.

The effect of noise on the ability to communicate is perhaps the most significant influence on the reaction of humans to noise. Communication interference may be due to a damaged hearing mechanism or to excessive sound intrusion.

Concern about excessive noise has been with mankind for most of his existence. 2,500 years ago the Greek community of Sybaris banned metal works and the keeping of roosters within the city in order to prevent sleep disturbance and speech interference. Julius Caesar cracked down on chariots after 10:00 p.m. in order that he could sleep without being disturbed. Industrial development over the past two centuries has caused a continuous increase in the extent of the noise problem. This increase in the number of noise sources and their level of output has caused increased public concern and prompted governmental action in response to citizens' demands for effective noise control programs.

Appendix 8

The Brochure, "Air Conditioning and Refrigeration Condensing Units: An Owners' Guide to Noise Control"

NOISE LEVELS CAN BE CONTROLLED

Noise is generally controlled by the suitable application of certain basic principles, i.e., isolation, insulation and interruption. Isolation means to locate noisy activities at points away from where people live or wor to minimize disturbances. Insulation refers to the use of absorptive materials on mechanical equipment to absorb as much acoustic energy at the source as possible. Interruption is the application of a high transmission loss material directly to the surface of a noise source or the blocking of the passage of sound through the installation of a barrier.

An acoustic enclosure can sometimes be used to reduce noise levels by up to 15 dB. Care must be taken in the design and construction of the enclosure to assure that air flow is not unduly restricted and that the discharge air does not recirculate into the inlet air stream. Because the performance of an enclosure may be highly directional, orientation is important to prevent degradation of the noise level on the discharge side of the enclosure.

The location of air conditioning and refrigeration condensing units at the rear of commercial buildings tends to enhance their ability to cause a noise problem at adjacent properties. Because the distance from the condensing unit to the property line is limited in many cases, relocating the unit toward the front of the building can be significantly helpful. A reduction in noise levels of 6 dB may be achieved with each doubling of the distance to the condensing unit.

The performance of a noise barrier is controlled primarily by its dimensions. A barrier of a practical size can be expected to reduce noise levels by 5 to 10 dB. Sometimes an accoustically absorbent material is applied to the face of the barrier next to the noise source to reduce the reflection of sound energy back toward the source.

THE STATE NOISE REGULATIONS

The Environmental Noise Act of 1974 of the State of Maryland declares as policy the limitation of noise to that level which will protect the health, general welfare and property of the people of the State. This act required that the Department of Health and Mental Hygiene develop and adopt regulations specifying allowable levels of noise and assume responsibility for their enforcement. The following regulations are effective through 1979:

Maximum Allowable Noise Level (dBA)
As Measured At The Receiving Property

	Industrial Property	Commercial Property	Residential Property
Daytime	80	72	65
Nightime	80	67	55

In 1980, these levels will be reduced by 5 dBA.

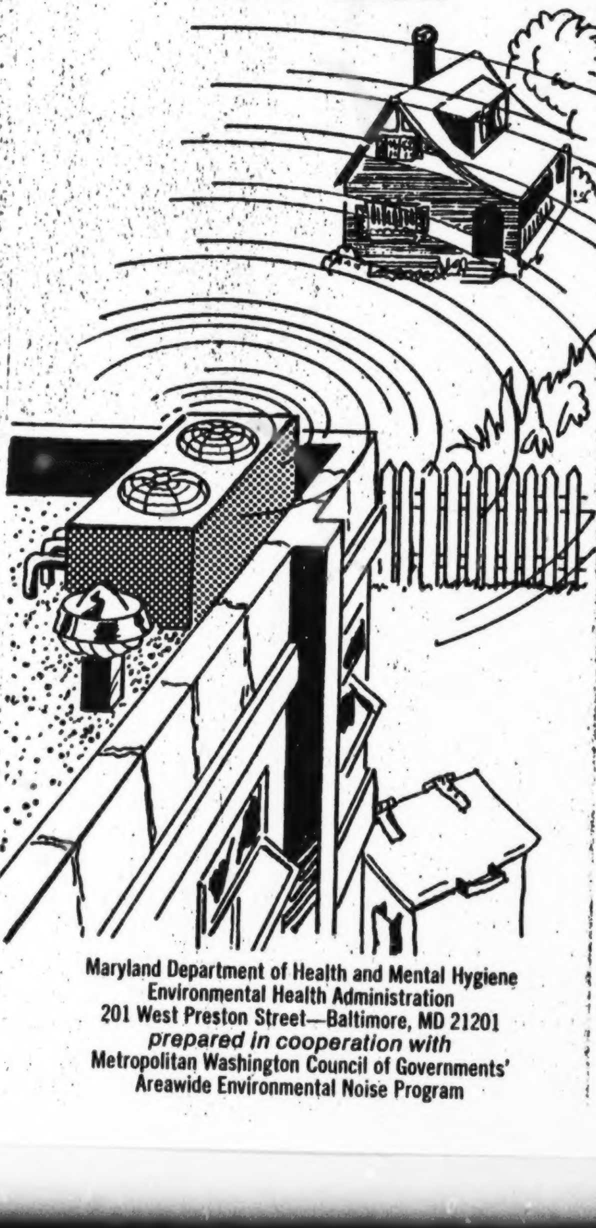
WHAT CAN YOU DO TO REDUCE NOISE?

When you install a new condensing unit, be sure to specify that the completed installation must demonstrate compliance with the State noise regulations before final payment is made. The Department has developed a simple nomograph, based on published data, which will aid in the selection and location of new units.

If an existing condensing unit is a problem, a solution can be found through equipment relocation, replacement with a quieter unit or the installation of a barrier or an enclosure. In some cases, the condensing unit may be shut down at night when people are the most sensitive to unwanted sound. Savings of energy and money are possible additional benefits. The degree of savings can be ascertained by either your equipment supplier or public utility representative. Your equipment supplier can advise how nighttime shutdown is likely to affect system performance and your electric utility supplier can indicate how operating costs may change.

For further information contact the Division of Noise Control: (301) 383-2727.

Air Conditioni and Refrigeration Condensing Units: An Owners Guide To Noise Control



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